The effect of knowledge stickiness and interaction on absorptive capacity

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The Effect of Knowledge Stickiness and Interaction on Absorptive Capacity

Evidence from furniture and software small- and medium-sized enterprises in Indonesia

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Evidence from furniture and software small- and medium-sized enterprises in Indonesia

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"It is not enough to have knowledge, one must also apply it.
It is not enough to have wishes, one must also accomplish."
- Johann Wolfgang von Goethe

Foreword

Writing a thesis is truly a long journey starting from knowledge gathering into synthesizing it and blending it with empirical evidence into a final manuscript. In doing so, it will be too pompous to say that this thesis is merely a personal product. Indeed, without helps from a lot of persons, directly and indirectly, this thesis will never be completed. Expressing my gratitude to those persons is the only thing I can do in return to their helps and supports from the beginning until the end of the writing process.

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Groningen, August 2010
Nurul Indarti

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1. Introduction

The first chapter of this thesis introduces the reader to the principal topics of our research, the concepts of absorptive capacity and the stickiness of knowledge. First, some background information regarding the study is provided, after which we will briefly touch upon our literature review of the current research on absorptive capacity, knowledge management, and interaction. After that, the research questions and objectives are formulated. Finally, we will sketch our research setting and explain the structure of the book.

1.1 Background

In a world of increasing competition where the business climate is becoming more and more dynamic, firms need to adapt and improve their products on a continuous basis in order to survive. With increasing frequency, they have to adjust their strategies to cope with a constantly changing and complex external environment (Teece, 1998). Businesses can no longer solely rely on their own resources, such as their internal knowledge, but have to seek and absorb knowledge from external parties as well. Companies may, for instance, take advantage from their buyers by exploring their preferences and using this knowledge to produce new goods/services. Other firms may use their competitors as knowledge sources by imitating their output. Other important sources of external knowledge are the Internet and magazines/newspapers. In short, in today's corporate world the absorption and use of relevant knowledge from the external environment is becoming increasingly important for businesses to improve their competitiveness. Cohen and Levinthal (1990) refer to this type of knowledge retrieval as a firm's absorptive capacity.

1.2 Absorptive Capacity

Absorptive capacity is a fundamental capability in the knowledge-dominated modern business era (Zahra and George, 2002). It is of particular importance for organizations in maintaining their position in the market. A firm's absorptive

capacity is an organizational construct, referring to the ability to absorb external knowledge and utilize it in generating innovative outputs (Cohen and Levinthal, 1990). The relevance of this construct is reflected by the importance of external knowledge in the stimulation of a firm's innovation activities.

The original concept of absorptive capacity was introduced by Cohen and Levinthal (1990). Since then it has been intensively studied and adapted by a fair number of scholars. The refined definition by Zahra and George (2002) formulates absorptive capacity as a set of organizational routines and processes, by which firms acquire, assimilate, transform, and exploit knowledge. From this perspective, innovation can be considered as the output of a firm's absorptive capacity (Lane et al., 2002).

Innovation is a complex process in which new knowledge is used to create commercial outputs (Fosfuri and Tribó, 2008). Innovation is based on knowledge, while in turn it generates new knowledge as its final output (Jorna, 2006). Part of this knowledge comes from external sources, such as buyers, suppliers, competitors, universities, business associations, and the media, i.e., magazines, television, and the Internet (Van Geenhuizen and Indarti, 2005; Cassiman and Veugelers, 2002). Therefore, knowledge – particularly from the external environment – and the capability to absorb and utilize this information form the engine of innovative growth (Pennings and Harianto, 1992; Jorna, 2006).

As the output of a company's absorptive capacity, innovation can be viewed from the perspective of the evolutionary theory (Nelson and Winter, 1982) as the adaptive behavior of organizations to deal with turbulent external business environments by actively focusing on producing high quality goods/services. Innovation is a multidimensional concept (Neely et al., 2001) that can be classified into product, process, and organizational innovation (Schumpeter, 1934; Avermaete et al., 2003; Van Geenhuizen and Indarti, 2005).

When conducting our literature review, we observed three major shortcomings in the studies on absorptive capacity (ACAP): 1) they showed limited attempts to revise the definition of absorptive capacity, 2) little attention was paid to the actual processes underlying absorptive capacity, and 3) only a few attempts were made to measure the concept in a context broader than that of R&D (see Liao et al., 2003). In addition, we also established that the vast majority of the research on absorptive capacity has been conducted within large companies, while there are only a few studies on this topic in the context of small- and medium-sized enterprises (SMEs). Moreover, these publications are particularly focused on developed countries (see Liao et al., 2003 and Waalkens, 2006), it is even less conducted in a developing country. This is why we chose to conduct

our research on absorptive capacity (concept and measurement) in the context of SMEs in Indonesia, a developing country (Jones and Craven, 2001).

In developing countries such as Indonesia, SMEs are often less familiar with the notion of knowledge management as an explicit and crucial task (Van Geenhuizen et al., 2010). Generally, the SMEs in developing countries obtain their knowledge through learning-by-doing and copying from other firms. Due to their relatively low absorption capacity, they are less capable of effectively searching for and using codified knowledge. As a result, they have to rely more on ad-hoc ways of transferring and absorbing knowledge (Van Geenhuizen et al., 2010). In addition, firms in developing countries lack the technological skills and resources to properly develop and mobilize their internal knowledge (Tsang, 1999; Narteh, 2008). In view of their economic survival however, it is crucial that they have sufficient access to the various sources of relevant knowledge in order to enhance their competitiveness in the market (Freeman and Hagedoorn, 1994; Kesidou and Szirmai, 2008).

In this study, we developed a framework of knowledge transfer which presents a broader perspective on the process of a firm's absorptive capacity. Knowledge transfer is a fundamental issue for organizations (Albino et al., 2004). It has become one of the most critical aspects in the knowledge management processes (Kuhn and Abecker, 1997). Knowledge transfer is defined as an interdependent exchange trajectory during which an individual or an organization offers and receives information (Ouchi, 1980). Transferring or absorbing knowledge refers to either combining existing with newly obtained knowledge, and/or interpreting existing knowledge in a different way (see Appleyard, 1996; Grant, 1996; March, 1991).

The goal of knowledge absorption is explained by the resource-dependency theory (i.e., Pfeffer and Salancik, 1978; Ulrich and Barney, 1984). This theory views an organization as an open system which cannot solely rely on its own resources (knowledge) for its survival, but which must also mobilize means from the external business environment. Most firms actively absorb and adopt resources (knowledge) from other companies.

The processes and mechanisms of knowledge transfer/absorption can be explained by the communication theory. We used the classic communication model of Shannon and Weaver (1949) and the refined model of Berlo (1960) as our points of departure. The communication theory views a knowledge transfer process as a path consisting of a series of steps in which a message, the "external knowledge", is conveyed from a source or sender to a receiver, "a firm which absorbs external knowledge". Furthermore, external knowledge can be communicated through various channels, such as face-to-face contact,

telephone, facsimile, and email. Here, the mechanism of the communication process, which sends the message to the receiver through a particular channel, can then be viewed as the process of absorptive capacity. Please note that the focus in this study is particularly on the absorptive capacity of the *receiver*, which means that the sender has not been taken into account. For a more in-depth discussion of a firm's absorptive capacity we refer to Chapter 2.

1.3 Knowledge Management

Knowledge plays an important role in all kinds of organizations and business contexts. Various scholars argue that knowledge is the most important source with respect to a firm's survival (e.g., Roberts, 1998; Civi, 2000; Carneiro, 2000). Both the resource-based and the knowledge-based theory stress the existence and importance of knowledge as a strategic resource in maintaining a firm's competitiveness (e.g., Penrose, 1959; Barney, 1991; Nonaka, 1994; Kogut and Zander, 1992; Grant, 1996). Knowledge as a strategic resource has a number of important criteria; it has to be valuable, rare, inimitable, and non-substitutable. This list of criteria is called the VRIO framework (Barney, 1991). Firms that utilize knowledge (existing as well as new knowledge) as a strategic asset may increase their competitiveness in the long run.

From the perspective of the internal organization, the management of knowledge is crucial and therefore an important business activity (Ostro, 1997). Knowledge management is considered as a process aimed at improving the effective acquisition, sharing, and usage of information by the organizational members of a firm (Maglitta, 1995; Civi, 2000; Dalkir, 2005; Nonaka and Takeuchi, 1995). As our research sample contains small- and medium-sized enterprises, where the role of the owners is predominant with respect to the initiatives and decisions associated with the absorption and utilization of information (Stanworth and Curran, 1976; Tidd et al., 2005), knowledge and its absorption are dealt with on both the individual (Polanyi, 1962; Nooteboom, 2004) and on the institutional level (Davenport and Prusak, 1998).

On the individual level, a firm's owner or staff member is viewed as a carrier of knowledge. Nonaka et al., (2000) argue that knowledge is essentially embedded in the human mind. Therefore, it is particularly associated with the experience, context, interpretation, and reasoning of the individual (Davenport and Prusak, 1998). On the institutional level, a firm is viewed as a collection of individuals (Davenport and Prusak, 1998). Here, organizational knowledge is considered as the accumulated knowledge of all individuals within the organization in combination with the organizational data and information documented (Nelson and Winter, 1982).

Several studies indicate that (new) knowledge characteristics can be viewed as independent as well as mediating variables. They determine the degree of knowledge recognition, acquisition, and assimilation by the organizational members (Lane et al., 2006). The various characteristics of knowledge can be categorized into content and type. Knowledge content includes depth (Porter, 1985) and the interconnectedness of the knowledge domains (Jorna, 2006; Van der Spek and Spijkervet, 1997). The knowledge types are classified on the basis of an individual and cognitive perspective. Three knowledge types are distinguished: sensory, coded, and theoretical (Nooteboom 1996; Jorna, 2006). Sensory knowledge refers to knowledge which can be practically applied or which is reflected in behavior. Coded knowledge refers to information which is available in manuals, instructions guides, and written procedures. This knowledge consists of specific codes. Theoretical knowledge is based on explanatory descriptions and chains of reasoning.

Certain characteristics of the knowledge types may render the absorption and imitation of the information more difficult. For instance, when a piece of knowledge is embedded in the mind of its carrier or only manifests itself in behavior, it may be difficult to transfer or absorb this information, let alone imitate it (Kogut and Zander, 1992; Reed and DeFillipi, 1990; Cijsouw and Jorna, 2003). In other words, because the knowledge is more difficult to absorb, it is less accessible to the receiver. This phenomenon is called the "stickiness" of knowledge (Von Hippel, 1994; Szulanski, 1996). Most discussions about the stickiness issue are primarily focused on the transfer or absorption of knowledge inside an organization (Brown and Duguid, 2001).

In this thesis, we have extended the context of the stickiness concept as introduced by Szulanski (1996, 2000) to the inter-organizational level, including the exchange of knowledge across organizations and that between organizations and their external environment. Our definition of knowledge stickiness refers to the degree of its accessibility (Culnan, 1985), that is the degree to which a piece of information is easy to understand or obtain. The current study specifically emphasizes the cognitive and the physical accessibility of external knowledge.

Stickiness affects the capability of a firm to access or obtain knowledge from the external environment. In this way, it has an impact on the level of a firm's absorptive capacity. As already indicated, this study has exclusively focused on the stickiness of external knowledge from the knowledge seeker's point of view. We have particularly concentrated on the characteristics of the knowledge and the channels. Therefore, the knowledge receiving firms have formed our principal research object; no specific attention has been paid to external parties (the senders of the knowledge).

As an illustration, some small firms that seek technical knowledge for solving particular production problems may perceive the information obtained as sticky because of its high complexity and its considerable access charges. From the point of the receiver, therefore, this knowledge is less accessible to absorb. Hence, the degree of absorptive capacity of these firms can be considered as low. The relationship between the stickiness of external knowledge and a firm's absorptive capacity has been dealt with by only a few empirical studies, conducted in developed countries. The contribution of our research is therefore twofold: it has extended the body of knowledge in this field and has shed more light on the situation in a developing country.

Knowledge management concerns both internal and external knowledge. In the context of this thesis, a firm's absorptive capacity indicates its potential and actual capability to process external knowledge. A detailed discussion about the aspects of knowledge management is presented in Chapter 3.

1.4 Interaction

Interaction may occur among the people within an organization as well as between a group of people and the environment. Our discussion about interaction primarily concentrates on the interaction between a firm and its external business environment, aimed at absorbing knowledge required for enhancing the organization's innovativeness. Previous studies have emphasized the importance of interaction as a basic element in the stimulation of a firm's absorptive capacity (e.g., Caloghirou et al., 2004; Nooteboom, 1992). Caloghirou et al. (2004) argue that for business firms, interaction is a key element in gaining access to, acquiring, and developing new knowledge (Caloghirou et al., 2004). Nooteboom (1992) uses term of 'external economy of cognitive scope' to explain the notion of interaction with the external environment. Furthermore, he views a firm as a 'focusing device', serving as a means of bringing people together on a shared mission to achieve a common goal (Nooteboom, 1992). This view implies that interaction facilitates the process of absorptive capacity, particularly in the context of the development of new product, process, and organizational innovations (Nooteboom, 2004).

Therefore, from the perspective of business firms, interaction is a precondition for the possibility to absorb knowledge from internal as well as external sources. In the innovation literature, a firm's interest in tapping into external knowledge sources is conceptualized by means of the open innovation concept (Chesbrough, 2003; Chesbrough et al., 2006).

The interaction processes among firms can be studied with the aid of the value chain analysis (Porter, 1985; 1990). This framework discusses the full range of interlinked activities (i.e., primary and secondary activities) from the development and production of a good/service to its sale in the final market. From the stakeholder perspective, the various parties involved in interaction are considered as those affecting or being affected by the actions of the business as a whole (Philips et al., 2003). These parties can be regarded as the *sources* of knowledge from the point of view of the knowledge seeker (the organization). We will discuss further details in Chapter 4.

1.5 Research Questions and Objectives

Based on the literature discussed above, we have formulated the main objective of this research study, which is to increase our insight into the phenomenon of absorptive capacity by particularly focusing on its main determinants: external knowledge and interaction.

As discussed in the previous section, firms require knowledge from the external environment in order to stimulate their innovation policies. For instance, the knowledge absorbed from customers may primarily be used to meet their product demands, while secondarily it may serve as the fuel for the development of innovations. In this sense, external knowledge is one of the most important resources for a firm in maintaining its competitiveness. In addition, certain characteristics of this knowledge (i.e., its interconnectedness and the degree to which it is sensory, coded, and theoretical) may influence the way in which companies (i.e., stickiness) are capable of absorbing the information to conduct their product, process, and organizational innovations. Based on this premise, the first main research question has been formulated:

Main research question 1:
What is the effect of the stickiness of external knowledge on a firm's absorptive capacity?

Interaction can be considered as one of the most effective ways to obtain relevant knowledge from the external business environment. Many scholars have argued that interaction among firms enhances their capacity to absorb external knowledge and use it in realizing their innovation projects (Ghoshal and Bartlett, 1988; Levinson and Asahi, 1995; Steensma, 1996; Lane and Lubatkin, 1998; Kastelli et al., 2004). In other words, a firm's absorptive capacity is influenced by the intensity of its interaction with other businesses in its environment. Firms learn to deal with external knowledge providers by interacting with them. So, the more intense the interaction among firms, the

higher their capacity to absorb external knowledge and utilize it. Hence, our second main research question is as follows:

Main research question 2:
What is the influence of interaction on a firm's absorptive capacity?

This research is aimed at improving our understanding of the relationships between external knowledge and its characteristics, and between a firm's absorptive capacity and its interaction with external parties. The main objective of this study is to gain new insights into the concept of absorptive capacity in the context of *SMEs in developing countries*, and to contribute to the debate on how to improve the conditions for these organizations in gaining access to knowledge. The results of this study are expected to be beneficial for various stakeholders, such as the SMEs, the interaction parties, and policy makers. The findings may serve as an instrument to be used by SMEs to improve their approach to dealing with external knowledge, whereby they can increase their absorptive capacity. Policy makers may use the results of this research in the development of new policies aimed at enhancing the absorptive capacity of SMEs to increase their competitiveness and in turn strengthen the national economy.

1.6 Research Setting

We conducted our study in Indonesia, a developing country, where we investigated small- and medium-sized enterprises (SMEs) in two knowledge intensive sectors: the furniture and the software industry. The furniture sector represents a well-established traditional manufacturing industry that has been closely embedded in the Indonesian society for a long time now. The furniture industry is considered as a less knowledge-intensive sector compared to, for instance, the software sector. In Indonesia the software branch is an emerging industry and can be considered as a more knowledge-intensive sector (see Box 1.1).

Box 1.1. Key facts concerning the Indonesian furniture and software industries

In 2005, the value of the Indonesian furniture export was USD 1.86 billion, which was 1.96% of the world market share. It could be positioned on the 14th place among the other furniture exporters (www.intracen.org). The furniture export contributes to 2.16% of the total national export. The growth of the furniture industries tends to increase from year to year. The value of the Indonesian furniture export rose from USD 1.8 billion in 2006 to USD 1,9 billion in 2007 (Investor Daily, 2007). This figure indicates that the export position of the furniture industries has benefited from the several kinds of innovations realized, which have made the furniture products more competitive in the international market.

According to an IDC report (Kompas, 26/09/2006), there are 56,500 software developers active in Indonesia. This number is considered to be relatively small compared to the situation in, for example, India, where the numbers reach 1 million and in China, where there are more than 500.000 software developers. The report also indicates that in 2009 Indonesia counted 1,100 information technology firms that employed 81,000 people of which 29.9% were software developers. The Association of Indonesian Software Developers (Aspiluki) states that 20% of the IDR 1.9 billion (USD 2.01 million) of the expenditures on information technology go to software development (Tempo, 2006). Given these facts, the software market in Indonesia has a huge potential.

1.7 Outline of the Thesis

This thesis consists of nine chapters (see Figure 1.1). Chapter 2 discusses the definitions and provides a basic description of the theories (the resource-dependency and the communication theory) used in our analysis of the process of absorptive capacity. In this chapter the determinants of the absorptive capacity of SMEs are also dealt with. In Chapter 3 we will address knowledge at the individual and the organizational levels, and further elaborate on the main knowledge theories and the issue of knowledge management, including the definitions and the knowledge life cycle. In addition, several characteristics of knowledge associated with the stickiness of knowledge are listed.

Chapter 4 introduces the framework and the definitions of interaction and its processes. In this chapter we will emphasize the importance of interaction of a firm with external parties, while all parties involved in this process are dealt with in more detail.

Based on the literature review, the research questions are presented in Chapter 5. Here, we discuss the conceptual model and the main research hypotheses as derived from the research questions.

Subsequently, in Chapter 6 we describe the methodology used in this research, as well as the research instrument and the way in which it was developed, the sampling strategy, the data collection procedure, and the data analysis methods.

An outline of the firms in the two industry sectors studied is given in Chapter 7, in which we also present the results regarding the degrees of knowledge stickiness, interaction, and absorptive capacity associated with the firms in our research sample. In addition to this, in Chapter 7 we will present the empirical research model, the research hypotheses, and the results of the hypotheses testing. Finally, Chapter 8 presents a discussion of our findings and concludes this thesis with a summary of the research findings and a discussion of the limitations of this study and its implications for future research.

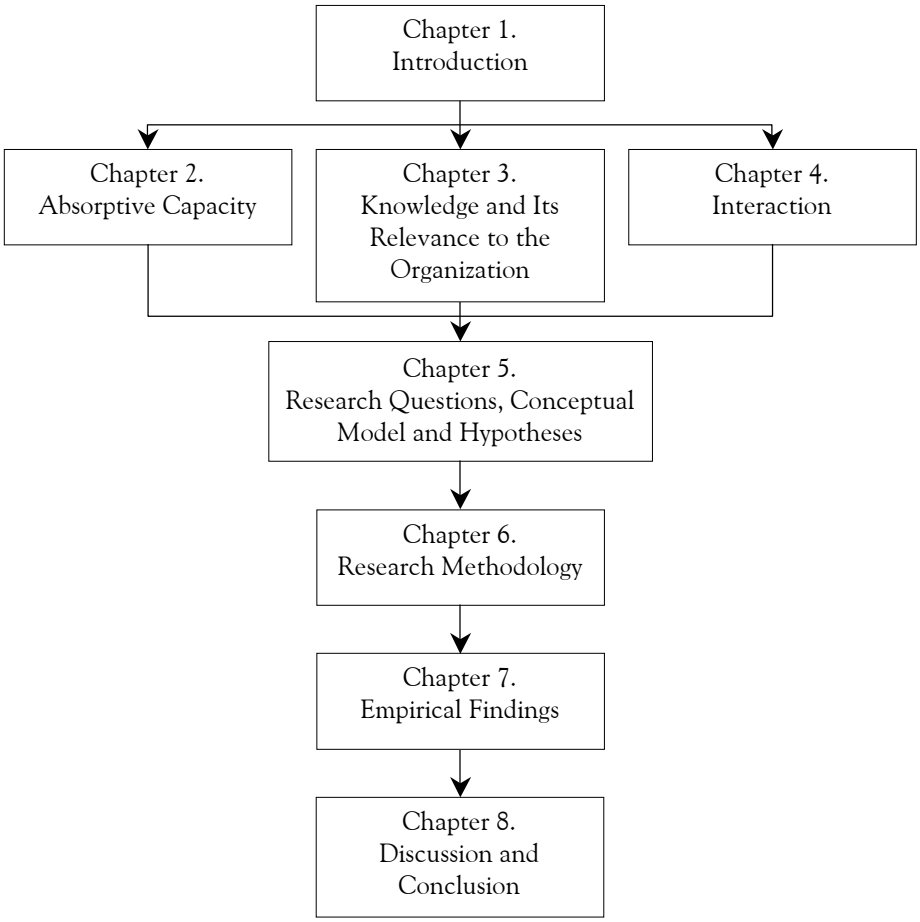

Figure 1.1. Structure of the thesis

2. Absorptive Capacity

2.1 Introduction

In this chapter, we present a review of the literature on absorptive capacity used in our study. First we will elaborate on the importance of absorptive capacity for firms confronted with changing knowledge environments. After that, we will discuss several definitions of absorptive capacity and the determinants of this concept as found in the literature. Finally, we will deal with absorptive capacity in the context of small- and medium-sized enterprises. Since this study is specifically focused on innovation at the firm level, the review has been restricted to this particular context.

2.2 The Need for Absorptive Capacity

Nowadays, the majority of firms are increasingly faced with globalization and a hardening of the competition. This is why organizations try to learn to develop their capabilities faster than their competitors. In order to survive, firms need to introduce new goods and services and find new ways of doing business on an ever more frequent basis. Further, they have to increase their flexibility in dealing with the changing nature and demography of their workforce. Some organizations may not be capable of pursuing such strategies for various reasons, such as a lack of capital, infrastructure/technology, and/or human resources (Freel, 2000; Rothwell, 1994). The decisions concerning the response to these external challenges by means of the innovation of products/services/organization should be regarded in the light of the specific objectives of the firm (Webster, 2004).

These processes are in line with the evolutionary theory (Nelson and Winter, 1982). The basic idea of the evolutionary model is "the idea of natural selection" … or "a view of organizational genetics – the processes by which traits of organizations, including those traits underlying the ability to produce output and make profits, are transmitted through time" (Nelson and Winter, 1982:9). In a competitive business environment firms are driven by the goal of making

profits, whereby there is a constant search for ways to increase these profits. In this context, a firm is assumed to possess certain capabilities which it can use in problem-solving situations. From an external point of view, a firms' ability to survive and grow is dependent on the market environment, which plays a determining role in a firm's success. The evolutionary theory of firms indicates the adaptive behavior of organizations and how they deal with turbulent external business environments that force them to provide goods/services of a better quality than those of their competitors.

In this study we will measure absorptive capacity in terms of innovation. The following section discusses the subject of innovation in more detail.

The innovativeness of firms may be affected by both internal and external factors. External factors are basically associated with a firm's environment consisting of other firms in the form of suppliers or buyers, in which there is the urgency for renewal (Jorna and Waalkens, 2006). Other external factors are the nature of the market, the production process, and knowledge spillovers (Webster, 2004). Internal factors include, for instance, a firm's inherited capacities, such as skills and the accumulated experience of its workforce (Webster, 2004), as well as the ability to respond appropriately to the intrinsic motivation of its employees (Jorna and Waalkens, 2006).

It has been argued that innovation plays an important role in a firm's survival in the business environment. Innovations can in this context be viewed as a multidimensional concept (Neely et al., 2001). Schumpeter, for example, defines innovation as "1) the introduction of a new good …; 2) the introduction of a new production method …; 3) the opening of a new market … 4) the opening of a new source of supply … 5) the carrying out of the new organization of any industry …" (Schumpeter, 1934:66). Similarly, Lundvall (1992) describes innovation as an ongoing process of exclusion, search, and exploration resulting in: 1) new products, 2) new techniques, 3) new organizational forms, and 4) new markets. In short, innovation can be considered as the introduction of something new into an organization (Jorna, 2006).

In addition, business literature offers various classifications of innovations that have been developed and applied (e.g., Schumpeter, 1934; Johannessen et al., 2001; Avermaete et al., 2003). Some authors (e.g., Avermaete et al., 2003; Johannessen et al., 2001) discuss innovation from the perspective of output (e.g. product, process, organizational), while others (e.g., Damanpour, 1996; Jansen et al., 2006; Abernathy and Clark, 1985) describe the concept in terms of the degree of change (i.e., radical and incremental). Yet another perspective used in capturing the dynamic process of innovation is that of the various stages of innovation (i.e., invention initiative and realized innovation).

2.2.1 The stage of an innovation process

Before an innovation is actually implemented, a firm has to generate ideas and develop plans. Rogers (2003) refers to this process as the initiation stage, defined as all the information gathering, conceptualization, and planning activities leading up to the final decision to adopt the innovation. A furniture firm, for instance, may develop plans to start the manufacturing of a new outdoor chair in the upcoming production-year, and a software firm may target a new market in a different region. In this study we refer to these activities as initiatives, defined as all new less formal ideas and plans under discussion within the firm, which are laid down in written documents. Generally, part of these initiatives are not being implemented as due to factors such as a lack of financial resources and/or skilled workers (Freel, 2000; Rothwell, 1994), a focus on short-term targets/requirements (Freel, 2000), and *force majeures* (e.g., an earthquake).

Wheelwright and Clark (1992) have labeled this phenomenon as the innovation funnel. According to Leonard and Sensiper (2000:287), the process of innovation is "a rhythm of search and selection, exploration and synthesis, cycles of divergent thinking followed by convergence." In more technical terms, they claim that the generation of ideas is followed by development, adoption or testing, and finally by implementation. As already mentioned, initiative is the result of divergent views or the generation of ideas, which ultimately yields innovation. During each subsequent step, the generation of ideas recurs on a smaller scale (Leonard and Sensiper, 2000), which means that the large input of ideas that comes into the funnel's entrance is filtered through an evaluation process, in which the best ideas are selected for further development, so that only a limited number reaches the other end of the funnel (Wheelwright and Clark, 1992).

2.2.2 Innovation output

As discussed above, innovation is the output of initiatives within a firm. Porter (1990:36) argues that a firm is a collection of activities that are performed to design, produce, market, deliver, and support its product. Following Porter (1990) we classify innovation output into three types: product, process, and organizational innovation (e.g., Avermaete et al., 2003).

Product innovation can be considered as any good or service that is perceived by an individual or a firm as new (Kotler, 1991). Therefore, one person or organization may regard a product as an innovation while another party does not (Johannessen et al., 2001). New designs of chairs/tables or software are perceived as a product innovation. Mostly however, product innovation is associated with changes in methods of processing (Avermaete et al., 2003). For instance, when a furniture firm has formerly used mahogany wood as a raw

material, it may need to adjust its production process if it decides to start using mahogany wood or jackfruit wood, since the wood types have to be processed differently. Other process changes may include the adjustment of the existing infrastructure, technology, or equipment. These examples of adjustment are called process innovation (Avermaete et al., 2003).

Process innovation can be defined as changes in the ways of producing or developing products, including new logistics, new raw material, new production lines, new production processes/methods, and new technology. This type of innovation does not stand on its own. In many cases, process innovation may be the consequence of product innovation or/and organizational innovation.

Organizational innovation is defined as changes in the ways of organizing and managing a firm, including human resource management and the improvement of the firm's access to the market (i.e., expanding new markets) (Avermaete et al., 2003). The relations among the three types of innovation can be illustrated as follows: when a furniture firm exploits a new market as the result of an organizational innovation, it may need to develop a new table design (a product innovation) in order to operate in this new market. As a consequence, the existing production lines may have to be adjusted, which requires, for example, the introduction of different material and new technology (a process innovation).

2.2.3 Degrees of change

Innovation may be categorized into the degree of change and the level of novelty or newness involved (Damanpour, 1996). Newness or novelty very much depends on the perception of the creator (i.e., the firm) (Tidd et al., 2005). A product perceived as an innovation by one firm may be considered as a mere modification or a common item by another one. One furniture firm may perceive a new model of an outdoor table as an innovation, whereas another one may consider it as the modification of an existing product. Similarly, the use of Java as a programming language may be new to some software firms, whereas other firms, which have used it for a number of years, may consider it as old technology. Therefore, the level of firms' experience in innovation plays an important role in this context.

Based on the degree of change, innovation can be subdivided into radical or exploratory and incremental or exploitative innovation. Radical or exploratory innovation entails fundamental changes in the activities of an organization and includes a clear deviation from existing practices. This type of innovation is aimed at meeting the needs of emerging customers or markets (Benner and Tushman, 2003). Examples of radical innovations are new designs, new markets,

and new channels of distribution (Abernathy and Clark, 1985). Radical innovation requires the generation of new knowledge out of existing knowledge (Benner and Tushman, 2003).

In the case of incremental or exploitative innovation, the focus is more on strengthening the existing capabilities of firms, which means that the existing products and/or processes are mainly subjected to minor changes (Gopalakrishnan and Damanpour, 1997). This type of innovation is meant to meet the needs of existing customers or markets (Benner and Tushman, 2003). Examples of incremental innovation are the elaboration of existing knowledge and skills, the improvement of existing designs, expansion in terms of increasing the existing products and services, and the improvement of the efficiency of the existing distribution channels (Abernathy and Clark, 1985). Incremental innovation therefore specifically builds on existing knowledge and reinforces the existing skills, processes, and structures (Abernathy and Clark, 1985).

Based on the above discussions, the main focus of innovation is to introduce something new (i.e., an entirely new product or a modification) into a firm (West and Farr, 1990).

Innovation is the application of new knowledge by which a firm is better able to meet the needs of its customers. This concept is given shape by the introduction of new (or improved) products or by providing a new (or an improved) service to customers. In this respect a better use of existing knowledge as well as a more effective acquisition and assimilation of (new) knowledge collected from external sources are very important for a business' growth. Since knowledge is the key to innovation, it is of great importance for an organization to be able to absorb, assimilate, and utilize knowledge from all available sources (Van den Bosch et al., 1999).

Firms can be viewed as open systems (e.g., resource-dependency theory (Ulrich and Barney, 1984)[1]). This means that in the case of innovation, some firms are not capable of mobilizing their existing resources (i.e., knowledge) but need to obtain (new) knowledge from other parties. These parties can be buyers, suppliers, universities, or other research institutions. The process of acquiring knowledge from others can be explained from the perspective of the resource-dependence theory.

[1] This theory will be explained in detail in Section 2.4. in connection with the concept of absorptive capacity.

Examining absorptive capacity (Cohen and Levinthal, 1990) [2], i.e. the ability of a firm to recognize and obtain external knowledge as a useful resource in the process of innovation, is a highly relevant task in gaining an insight into the dynamics of a firm's innovativeness. Many authors argue that absorptive capacity promotes the speed, frequency, and magnitude of innovation, which in turn generates new knowledge that again becomes part of the absorptive capacity of the organization (Kim and Kogut, 1996; Helfat, 1997; Van den Bosch et al., 1999).

2.3 Absorptive Capacity

The concept of absorptive capacity has been considered as one of the most important concepts that have emerged in the field of organizational research in the past years (Lane et al., 2002). Earlier studies indicate a consensus on absorptive capacity as a set of organizational routines necessary to identify and utilize generated knowledge (e.g., Zahra and George, 2002). The concept of absorptive capacity was originally introduced in macroeconomics, where it refers to the ability of an economy to utilize and absorb external information (i.e. knowledge) and resources (Adler, 1965) in Tua et al., (2006).

Cohen and Levinthal (1989:569) have adjusted this macroeconomic concept to organizations and define it as "the ability to identify, assimilate, and exploit knowledge from the environment – what we call a firm's 'learning' or 'absorptive capacity'. Given the importance of external knowledge to industrial innovation, "absorptive capacity represents an important part of a firm's ability to create new knowledge" (1989: p. 570).

In 1990 Cohen and Levinthal (1990:128) redefined the concept as "the ability of a firm to recognize the value of new external information, assimilate it, and apply it to commercial ends". This definition represents a single-loop learning process (absorptive capacity → learning → new absorptive capacity). A single-loop learning process is initiated when a firm has detected certain errors and wants to correct these errors during the ongoing business procedures in order to continue its present policies or to achieve the planned objectives without any modifications to the organization's underlying norms, policies, and goals (Argyris and Schön, 1978:2-3). From this perspective absorptive capacity is viewed as a firm-level construct, which expresses the cumulative effect of continuous organizational learning.

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[2] According to Cohen and Levinthal (1989; 1990), innovation is no longer regarded as a calculable, purely technical process but rather as a knowledge intensive activity requiring managerial and technical capabilities as well as external linkages to information acquisition, cooperation, and networking, as cited in Koch and Strotmann (2008).

According to Cohen and Levinthal (1990:131), although "a firm[3]'s absorptive capacity will depend on the absorptive capacities of its individual members. It is not, simply the sum of the absorptive capacities of its employees, and it is therefore useful to consider what aspects of absorptive capacity are distinctly organizational. […] It refers not only to the acquisition or assimilation of information by a firm but also to the firm's ability to exploit it". The Cohen and Levinthal's definition, however, primarily deals with external knowledge. It implicitly suggests that firms are aware of their internal knowledge but have no access to it (Tua et al., 2006). Apart from not having access to their knowledge, there may be cases, in which organizations are not aware of their knowledge. This especially applies to tacit knowledge, which can only be communicated by direct, i.e., physical and social interaction. The internal diffusion of new knowledge and technology requires a network of both formal and informal communication linkages (Jones and Craven, 2001).

The concept of absorptive capacity has been used in many different research fields, such as strategic management (e.g., Nahapiet and Ghoshal, 1998; Van den Bosch et al., 1999), organizational learning (e.g., Barkema and Vermeulen, 1998), knowledge management (e.g., Lane and Lubatkin, 1998), external interactions (e.g., Caloghirou et al., 2004), and innovation management (e.g., Helfat, 1997; Van den Bosch et al., 1999). Only a few scholars have explicitly attempted to revise and expand Cohen and Levinthal's original definition, as summarized in Table 2-1. Lane and Lubatkin (1998) have developed the notion of relative absorptive capacity. They have reconceptualized the firm-level concept of absorptive capacity as a learning dyad-level construct, arguing that "the ability of a firm to learn from another firm is jointly determined by the relative characteristics of the two firms" (Lane and Lubatkin, 1998). Further, they have distinguished absorptive capacity into three dimensions: 1) the ability to recognize and value new external knowledge; 2) the ability to assimilate new external knowledge; and 3) the ability to commercialize new external knowledge.

Van den Bosch et al., (1999) have developed a more integrated framework of the co-evolution of a firm's path-dependent absorptive capacity and the knowledge environment. They argue that Cohen and Levinthal's implicit feedback loop is dependent on the environment in which a firm competes and on its success in coping with this environment. When the business environment changes, the firm will respond to this situation, and if its response does not work as expected, the firm will try to improve it.

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[3] The original term used by Cohen and Levinthal (1990) is "organization". In the context of this study, the term used is "firm".

More recently, Zahra and George (2002) have presented a re-conceptualization of Cohen and Levinthal's interpretation of absorptive capacity. Zahra and George picture absorptive capacity as a set of organizational routines and processes, by which firms acquire, assimilate, transform, and exploit knowledge. They also propose that these four organizational capabilities (i.e., acquisition, assimilation, transformation, and exploitation) build on each other to yield even more absorptive capacity. A firm's absorptive capacity is viewed as a dynamic capability[4] that influences the organization's ability to create and deploy the knowledge necessary to build other organizational capabilities (Zahra and George, 2002). Furthermore, they suggest that absorptive capacity may be divided into 'potential' absorptive capacity (acquisition and assimilation) and 'realized' absorptive capacity (transformation and exploitation).

This notion of absorptive capacity, however, is mainly relevant in the context of large firms. In large firms, organizational functions such as planning, organization, leadership, and control are separated in various functions. The initiatives and decisions with respect to the acquisition and utilization of new external knowledge are made by various people (i.e., management and employees) in the firm. This condition is significantly different from the context of small firms, especially in a developing country. Managerially, the small firm is usually administered by one individual (i.e., the owner of a firm), also called a 'one man show', rather than by a formalized management structure (Stanworth and Curran, 1976). In other words, in the case of small firms all initiatives and decisions are highly dependent upon the company owner's abilities.

Based on the aforementioned as summarized in Table 2.1, we have adopted the original definition by Cohen and Levinthal (1990) in the context of this study, while supplementing the interpretation of Zahra and George (2002). This resulted in the following definition of a firm's absorptive capacity: the ability of a firm to absorb new external knowledge and use it to further develop new products, processes, or services. This definition implies that (new) knowledge from outside is a fundamental element of the concept of absorptive capacity. Therefore, our study has focused mainly on external knowledge (i.e., its characteristics) and its impact on a firm's absorptive capacity. Chapter 3 discusses external knowledge and its characteristics in more detail. Zahra and George (2002) suggest that absorptive capacity may be divided into potential

[4] According to Helfat et al., (2003:4), "a dynamic capability is the capacity of an organization to purposefully create, extend, or modify its resource base". Furthermore, the resource base of an organization includes tangible, intangible, and human assets (or resources) as well as capabilities which the organization owns, controls, or has access to on a preferential basis (ibid). The type and importance of resources for an organization will be discussed in detail in Chapter 3.

and realized absorptive capacity. Using their categorization in the setting of SMEs may broaden the understanding of the concept of absorptive capacity in its various contexts.

Table 2.1. Definitions of absorptive capacity

Author (Year)	*Definitions*	*What is new?*
Adler (1965)*	Absorptive capacity is the ability of an economy to utilize and absorb external information (or 'knowledge') and resources	Macroeconomic point of view
Cohen and Levinthal (1989)	Absorptive capacity is the ability to identify, assimilate, and exploit knowledge from the environment	Adjusted the concept to the organizational context
Cohen and Levinthal (1990)	Absorptive capacity is the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to achieve commercial ends	Redefined absorptive capacity as representing a single-loop learning
Lane and Lubatkin (1998)	Relative absorptive capacity is the ability of a firm to learn from another firm through a student-teacher pairing approach, called a learning dyad	Distinguished three dimensions of absorptive capacity: 1) the ability to recognize and value external knowledge; 2) the ability to assimilate new external knowledge; and 3) the ability to commercialize new external knowledge
Van den Bosch et al. (1999)	Absorptive capacity comprises evaluation, acquisition, integration, and the commercial utilization of new outside knowledge	Developed a more integrated framework of the co-evolution of a firm's path-dependent absorptive capacity and the knowledge environment
Zahra and George (2002)	Absorptive capacity is a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge	Reconceptualized absorptive capacity as a dynamic capability of a firm, which consists of potential absorptive capacity (i.e., acquisition and assimilation) and realized absorptive capacity (i.e., transformation and exploitation)

Note: *Cited in Tua et al. (2006)

2.4 Understanding the Process of Absorptive Capacity

As explained in the previous section, a firm's absorptive capacity can be regarded as a process aimed at acquiring knowledge from other sources, absorb this external knowledge, and utilize it for realizing commercial output. The process of absorptive capacity can be analyzed by means of the knowledge transfer framework. Several authors argue that knowledge transfer is considered as a fundamental issue for organizations (Albino et al., 2004) and that it has become one of the most critical aspects in knowledge management processes (Kuhn and Abecker, 1997). Ouchi (1980) defines knowledge transfer as an interdependent process involving an exchange during which an individual or an

organization gives and receives information. This process has specific goals that can be conceptualized as a continuum, ranging from the exploration of new knowledge through a renewed combination of existing knowledge (Appleyard, 1996) to the exploitation of existing knowledge (Grant, 1996). According to March (1991), the goal of knowledge transfer is either to explore new knowledge or to exploit existing knowledge, although often the process will be aimed at both objectives.

From another perspective, Argote and Ingram (2000) define knowledge transfer as the process through which an organizational unit is affected by the experiences of other parties. Referring to the organizational dimension, most authors agree that knowledge transfer depends on the characteristics of the individuals involved, such as experience, values, motivation, and beliefs (Albino et al., 2004). Moreover, knowledge transfer is strongly affected by the relationship between source and recipient. Hansen (1999) shows how strong ties among groups positively affect the transfer of complex knowledge.

Many studies have attempted to explain why and how knowledge transfer takes place among firms. Using a framework of knowledge transfer may offer a more profound understanding of the reasons why a firm needs absorptive capacity and how it is organized.

The basic explanation for the phenomenon of knowledge transfer from one firm to another in order to absorb external knowledge is given by the resource dependency theory (i.e., Pfeffer and Salancik, 1978). The resource-dependency theory views a firm as an open system, which means that it (1) is not self-sufficient; (2) cannot generate all necessary resources internally; and (3) has to mobilize resources from other organizations in its environment in order to survive. This is why most firms are deliberately focused on adopting resources from other organizations[5]. Pfeffer and Salancik (1978:258) argue that "*to survive, organizations require resources. Typically, acquiring resources means the organization must interact with others who control those resources. In that sense, organizations depend on their environments. Because the organization does not control the resources it needs, resources acquisition may be problematic and uncertain. Others who control resources may be undependable, particularly when resources are scarce. … Survival of the organization is partially explained by the ability to cope with environmental contingencies; …*". According to Barney (1991:101), firm resources can be defined as, "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enables the firm to conceive of and implement strategies that improve its efficiency and

[5] Other firms involved will be discussed in detail in Chapter 4.

effectiveness". So in the current competitive environment, knowledge is a fundamental asset for organizations. It is in fact one of the most important resources (Teece, 1998).

From this perspective, organizations can be viewed as a coalition, which influences their structure and patterns of behavior to acquire and maintain external resources. According to Ulrich and Barney (1984), a firm can acquire external resources by either decreasing or increasing its dependence on other organizations, that is, its power can be modified through its interaction with other parties.

We therefore argue that due to the insufficiency of their existing resources firms need to absorb means (e.g., knowledge) from outside, especially when the market competition increases. Firms can absorb this knowledge from other parties, such as customers, competitors, universities, and business associations or through addressing other means, such as radio, television, newspapers, and the Internet.

In order to acquire a better understanding of how knowledge transfer takes place, we adopted the classical communication model of Shannon and Weaver (1949) and a refined version by Berlo (1960) as our starting point. Shannon and Weaver's model depicts communication as a linear process, its purpose being purely quantitative. It views this process as a series of steps during which a message is conveyed from a source or sender to a destination or a receiver. Instead of using a mathematical formulation as is done by Shannon and Weaver, Berlo (1960) applies verbal descriptions. Berlo's model defines the components of the communication process as sender, message, channel, and recipient, thereby providing verbal descriptions of how each item affects the communication process. By combining Shannon and Weaver's approach with Berlo's refined version in defining the main components of the communication model and describing the knowledge transfer process, the following framework has resulted.

Communication theory can provide a useful underpinning for the knowledge transfer framework. As Figure 2.1 shows, the sender becomes the "source" of knowledge which transmits a message through a channel to a receiver. The recipient is the "receiver", i.e., a firm which absorbs external knowledge. In the context of this study, the receiver's ability to acquire, assimilate, and utilize external knowledge is labeled as the firm's absorptive capacity (Cohen and Levinthal, 1990) as explained in the previous section. The message is the "external knowledge" which is communicated through various channels, such as face-to-face contact, telephone, fax, and email. Insight can be gained into a firm's absorptive capacity by focusing on the structure of the communication

between the external environment and the organization, as well as that among the subunits of the organization, and on the character and distribution of the expertise within the organization (Cohen and Levinthal, 1990:132). According to the communication theory's point of view, a communication channel can be defined as a means by which information or knowledge is being moved from one point to another within a social system (Chakrabarti et al., 1983). This is why the communication channel plays an important role in the degree of a firm's absorptive capacity.

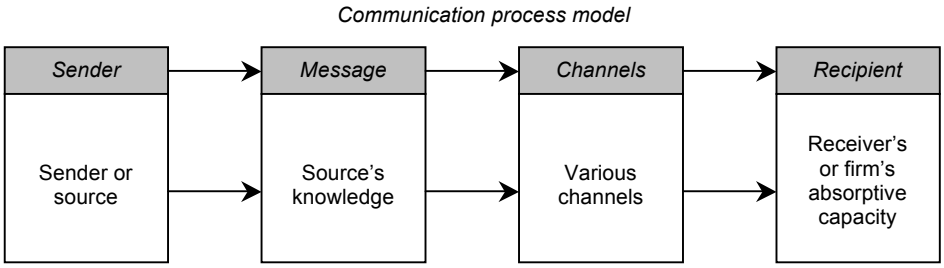

Figure 2.1. Understanding knowledge transfer by using the theory of communication

According to Arrow (1969), communication channels differ in terms of costs (or, equivalently, capacities). These differences may influence a receiver firm with respect to the extent to which it can absorb external knowledge. Furthermore, Arrow emphasizes that mass media play a major role in alerting individuals or organizations to the possibility of an innovation, while personal contact seems to be the most relevant instrument in leading to its adoption (Arrow, 1969). In the context of this study, we will explore various types of communication channels used by firms to obtain or absorb knowledge from other organizations. Section 3.6.2.3 of Chapter 3 discusses this issue in more detail.

We want to note that in the context of this study, absorptive capacity is conceived from the receiver's point of view (i.e., the focal firm). So, we will focus on the characteristics of the message (i.e., knowledge) and on the characteristics of the channels. We will therefore not pay any specific attention to external firms (i.e., the senders of the knowledge).

2.5 The Determinants of Absorptive Capacity

A study carried out by Lane et al. (2002) concludes that the determinants of a firm's absorptive capacity have only been scarcely examined. Of these few studies, Daghfous (2004) has provided an overview of the determinants of absorptive capacity which have mainly been derived from the work of Cohen

and Levinthal (1990). The determinants of absorptive capacity can be broadly categorized into two groups: internal and external factors (Daghfous, 2004). Internal factors include the prior knowledge base, the level of education, the presence of gatekeepers, and investments in R&D. External factors contain external knowledge and the interaction with other firms. Each factor will be elaborated in detail in the following section.

2.5.1 Internal factors

Prior related knowledge

Cohen and Levinthal (1989:569-570) introduce the absorptive capacity construct as follows: "the firm's ability to identify, assimilate and exploit knowledge from the environment," pointing out that "a stock of prior knowledge … constitutes the firm's absorptive capacity". In another article, they consider the level of prior related knowledge as the determinant of a firm's absorptive capacity (Cohen and Levinthal, 1990). According to Kim (1998), a prior knowledge base is the sum of all individual units of knowledge within an organization. Prior related knowledge has a positive effect on a firm's absorptive capacity because it determines the level of a firm's ability to perform three principal activities: to acknowledge the value of the new knowledge, to assimilate it, and to apply it for commercial ends (Cohen and Levinthal, 1990). In addition, Cohen and Levinthal (1990) argue that prior related knowledge, also called internal knowledge, is crucial in developing and adopting new knowledge. So far, most authors, following Cohen and Levinthal (1990), have considered the level of prior related knowledge (such as learning experience and shared language) as an important determinant of absorptive capacity.

Level of education

According to Vinding (2000), the employees' level of education is another determinant of absorptive capacity. The more education and training individuals have received, the higher their ability to assimilate and use new knowledge. As a firms' absorptive capacity depends on that of its organizational members, the level of education and training of these individuals has a positive influence on the level of the absorptive capacity of this organization (Schmidt, 2005). In addition, Rothwell and Dodgson (1991) argue that in order for a firm to gain proper access to knowledge from outside its boundaries, a sufficient number of qualified technical specialists, scientists, and engineers is required. Moreover, prior skills stimulate creativity through the development of novel ideas by combining new and old knowledge (Daghfous, 2004).

The presence of gatekeepers
The presence of so called 'gatekeepers' plays an important role in determining absorptive capacity. The main role of gatekeepers is reducing the communication gaps and mismatches between the providers and the users of knowledge (Daghfous, 2004). Vinding (2000) states that the gatekeeper, whose role it is to create a language that can be understood by all different departments and parties involved, can improve a firm's absorptive capacity through knowledge sharing.

Cohen and Levinthal (1990) introduce two types of gatekeepers, 1) the one who acts as a boundary spanner within the firm and 2) the one who serves as an interface between the firm and the environment. As a boundary spanner, the gatekeeper functions as a transducer of intra-firm knowledge (Afuah, 2003), who converts the available knowledge within a firm into a form or with additional information that is more accessible to members of the firm. As an interface, the gatekeeper links the organization with the external information sources, acting as the transducer of inter-firm information (Afuah, 2003). Gradwell (2003) argues that the role of the gatekeeper as an interface is to screen the environment for relevant knowledge and transform this information in such a way that it can be understood by the firm's employees. In addition to detect knowledge and bring it into the firm, as an interface, the gatekeeper also may send information into the environment presenting the firm in a favorable light.

Firm's size and age
Daghfous (2004) claims that size can affect a firm's absorptive capacity. Larger firms with sufficient R&D resources are likely to be more innovative than smaller firms, which in most cases have only limited R&D capacities. This situation suggests that a firm's innovativeness (the outcome of absorptive capacity) and its size are positively correlated.

In their study of high-tech firms, Lee and Sung (2005) indicate that size as measured by the number of employees, is significantly related to R&D activities, which are often used as an indicator to measure a firm's absorptive capacity (Cohen and Levinthal, 1990). A study by Liao et al., (2003) however, suggests that compared to large organizations, smaller firms are better capable of responding to changes and introducing innovations, because these organizations have less bureaucracy and their business culture is less hierarchical.

Sørensen and Stuart (2000), who studied high-tech firms, state that a firm's age as measured by a firm's number of patents is positively correlated with absorptive capacity. Further, a study on innovation in Belgian small food firms by Avermaete et al. (2003) shows that older firms are more likely to introduce

new products than younger ones. These findings support the claim that as a firm grows older, its organizational operations and competencies have gradually improved, which promotes a climate for innovation (Sørensen and Stuart, 2000). Lee and Sung (2005) however, show that age has a negative impact on a firm's absorptive capacity.

Investments in R&D

In studying absorptive capacity Cohen and Levinthal (1989) mainly focus on the role of R&D expenditures. They also point to the dual role of R&D in the innovation process of firms: realizing absorptive capacity and generating new knowledge and innovations. Many authors use R&D to model absorptive capacity at the firm level. Daghfous (2004) argues that investments in R&D have repeatedly been found to play a critical role in the improvement of the skills of the employees. The relationship between R&D spending and absorptive capacity seems to be bi-directional (Daghfous, 2004): absorptive capacity influences the direction and intensity of R&D (Vinding, 2000), while the R&D investments in turn affect the efficiency of absorptive capacity (Daghfous, 2004).

Organizational structure and human resource practices

It has also been argued that the absorptive capacity of a firm is determined by its expertise in stimulating and organizing knowledge sharing (Van den Bosch et al., 1999). Daghfous (2004) states that a firm's organizational structure and its cross-functional communication can improve its absorptive capacity (Van den Bosch et al., 1999; Lane and Lubatkin, 1998). Furthermore, in order to improve absorptive capacity, the organizational structure should be flat, flexible, adaptable, dynamic, and participative (Daghfous, 2004). In addition, Gradwell (2003) points to the strong positive influence of close networks and relationships within firms on the transfer of tacit knowledge.

Closely related to the organizational structure are human resources. Human resource practices stimulate job rotation and encourage employees to read relevant literature and monitor developments that help process the flows of knowledge (Mahnke et al., 2003). In addition, human resource management can help in stimulating learning through reward and training systems (Daghfous, 2004). These approaches can be used to increase the absorptive capacity of the individuals, thereby improving the absorptive capacity of the organization as a whole (Schmidt, 2005). Furthermore, the structures, tools, and incentives of an organization are usually determined by the management (i.e., the owner/manager) to stimulate the exchange of knowledge and learning (Schmidt, 2005). Lenox and King (2004) argue that in order to build absorptive capacity managers need to take part in the process of knowledge provision and sharing.

2.5.2 External factors

External knowledge

Daghfous (2004) mentions the external knowledge environment as another factor which is crucial for absorptive capacity. In fact, a firm does not exist alone in its environment. As an open system (i.e., resource dependency theory), a firm constantly interacts with its external environment, such as its suppliers and its buyers, by exchanging knowledge (Nonaka and Takeuchi, 1995). This knowledge may partly consist of new capabilities to improve the firm's absorptive capacity (Dahgfous, 2004). In this respect, Waalkens (2006) shows in a study conducted among firms in the architectural and engineering sectors in the Netherlands, that the extent to which organizations are capable of gathering external knowledge is one of the predictors of innovation activity. Furthermore, Waalkens (2006) finds indications that knowledge from its suppliers and its competitors is particularly important for a firm's innovation process.

After reviewing 289 absorptive capacity papers, Lane et al. (2006) have distinguished two main focuses underlying a firm's absorptive capacity. The first focus concerns the characteristics of the external knowledge, which affect its absorption and assimilation by the organization. The second focus concerns the different characteristics of knowledge within the organization. In other words, knowledge characteristics "… have been viewed both as independent and as mediating variables that affect knowledge recognition, acquisition, and assimilation" (Lane et al., 2006:846).

Furthermore, several knowledge characteristics[6] have been studied, namely 1) knowledge content or "know what", and 2) tacitness or "know how" (Lane et al., 2006). Lane et al. also argue that the effect of knowledge characteristics, for example content and type (i.e., sensory, coded, and theoretical) – to be explained in Chapter 3 – on a firm's absorptive capacity has received relatively little attention. The current study intends to fill this gap.

Interaction

Scholars have identified interaction as one of the main determinants of a firm's absorptive capacity. According to Lane and Lubatkin (1998), interaction among firms affects their ability to recognize, value, and absorb new external knowledge. Other examples of studies which share the view that interaction and relations among firms strengthen these organizations' absorptive capacity are those of Ghoshal and Bartlett, (1988), Levinson and Asahi (1995), and Steensma (1996). Caloghirou et al., (2004) have investigated the extent to which the interaction of a firm's internal capabilities with external sources of knowledge affects the

[6] Knowledge and its characteristics will be discussed in detail in Chapter 3.

level of the organization's innovativeness. Yli-Renko et al. (2001) state that repeated interaction enhances firms' ability to acquire knowledge from other organizations and evaluate its relevance. Similarly, Dyer and Singh (1998) suggest that a firm's ability to identify, assimilate, and apply another firm's knowledge is based on sociological interactions and collaborative processes which are determined by both the organization's members and the external partners.

In addition, connections with external sources of public and private nature can help a firm in building absorptive capacity (Cockburn and Henderson, 1998; Powell et al., 1996). Also Waalkens (2006) finds that in the construction sector in the Netherlands, firms which collaborate on a more frequent basis positively contribute to innovation. In this respect it has to be added that face-to-face interaction in a close physical proximity stimulates the sharing and development of knowledge in order to realize innovation.

Tabel 2.2 summarizes the internal and external determinants of a firm's absorptive capacity.

Table 2.2. Internal and external determinants of absorptive capacity

No.	*Determinants*	*Effect*	*References*
	Internal		
1	Prior related knowledge (internal knowledge base)	+	Cohen and Levinthal (1990); Nonaka and Takeuchi (1995); Waalkens (2006)
2	Level of education	+	Vinding (2000); Rothwell and Dodgson (1991)
3	Presence of gatekeepers	+	Vinding (2000); Gradwell (2003)
4	Firm size and age	+ / -	Liao et al. (2003); Sørensen and Stuart (2000), Avermaete et al. (2003); Lee and Sung (2005)
5	Investment in R&D	+	Cohen and Levinthal (1990); Veuglers (1997); Vinding (2000)
6	Organizational structure and human resource practices	n.a	Van den Bosch et al. (1999); Kogut and Zander (1992)
	External		
1	External knowledge	+	Nonaka and Takeuchi (1995); Lane et al. (2006); Waalkens (2006)
2	Interaction	+	Ghoshal and Bartlett (1988); Levinson and Asahi (1995); Steensma (1996)

Source: Adopted from Daghfous (2004)

2.6 The Absorptive Capacity of Small- and Medium-sized Enterprises

As the literature indicates, the vast majority of the research on absorptive capacity has been conducted within large companies, while there are only a few studies on this topic in the context of small- and medium-sized enterprises (SMEs) (see Liao et al., 2003 and Waalkens, 2006 in the context of developing countries). This means that absorptive capacity research on the level of SMEs is

scarce (Liao et al., 2003). In addition, different ways of measuring absorptive capacity are needed on the SME-level (Jones and Craven, 2001).

Liao et al. (2003) have examined absorptive capacity and its relationship with firm responsiveness among growth-oriented SMEs in the United States. In a more recent study, Waalkens et al. (2008) has adopted an extended concept of absorptive capacity developed by Zahra and George (2002) in the context of Dutch architectural and engineering SMEs. In Waalkens' study, R&D expenditure, the only indicator variable used in this type of study, was complemented with other alternative measures of absorptive capacity.

There are several characteristics that differentiate SMEs from large firms. Generally, in contrast to large firms, SMEs are usually characterized by relatively simple organizational structures. This is why it is easier for an SME to adapt, internalize, and crystallize new information and disseminate it more efficiently across the entire enterprise (Pelham, 2000). In addition, since SMEs have only a limited range of products and customers, they can minimize the requirements for their formal decision-making procedures (Appiah-Adu and Singh, 1998). Chen and Hambrick (1995) argue that smaller firms are also quicker and more agile than their larger counterparts because of their structural simplicity and the fact that their operation trajectories are shorter and therefore more streamlined.

However, many SMEs are characterized by their lack of long-range focus, strategic orientation, systematic decision-making, and customer orientation (Sexton and Van Auken, 1982). In addition, their decision-making tactics are often described as ad-hoc and short-term, while their decision-making processes are generally centralized. Furthermore, these processes are often strongly linked to the owner of the firm or the key manager (Tidd et al., 2005). They are usually the creative minds and the central figures that make the strategic decisions and initiate the innovative activities within the firm (Johannisson, 1998).

As regards these aspects large firms are different. Mostly, large firms are better capable of achieving economies of scale in their operations (Hambrick et al., 1982) and generally they have a broader range of resources at their disposal (Singh, 1990), which can be used to strengthen their competitive position and absorb the shocks of change or drawbacks. Large firms can typically benefit from their greater size. They can more easily acquire market share on the basis of their product lines and reputation, exploit their patents, introduce economies of scale in their research and development activities, use their bargaining power over their suppliers and buyers, and dominate the market through pricing leadership (Porter, 1980; Scherer and Ross, 1990). Furthermore, large companies usually have a special business unit engaged in developing initiatives and making decisions in the field of innovation, called an R&D department.

2.7 Conclusion

A firm's ability to absorb, assimilate, and utilize knowledge from outside, also called a firm's absorptive capacity, is crucial for its survival. We have discussed several theories which provide a broader understanding of the concept of absorptive capacity in a business context. In our study, we used a knowledge transfer framework as our starting point. More specifically, both the evolutionary theory and the resource-dependency theory were introduced to gain an insight into the dynamics of absorptive capacity in a business context. Further, we addressed the communication theory to capture the concept's processes and mechanisms.

Innovation as one of the main indicators of absorptive capacity has also been discussed in detail, with a particular focus on issues such as the degree of change, the different stages, and the target outputs. In order to obtain a broader understanding of absorptive capacity in the context of SMEs, we adopted Cohen and Levinthal's original definition (1990) and added the description presented by Zahra and George (2002), suggesting that the concept may be divided into potential and realized absorptive capacity.

The determinants of the absorptive capacity of firms as identified by the previous studies can generally be grouped into two main categories: internal and external factors. Since absorptive capacity is closely related to external knowledge (Cohen and Levinthal 1990), the current study will particularly pay attention to external determinants i.e., the characteristics of external knowledge and the interaction between a firm and its environment as the source of this external knowledge. The characteristics of external knowledge that have an impact on a firm's absorptive capacity are discussed in Chapter 3, while Chapter 4 deals with the interaction between a firm and its environment. Furthermore, several internal determinants which are considered to be relevant in the context of SMEs (i.e., a firm's age, its size, and the level of education of its employees) will also be taken into account (see Chapter 5).

3. Knowledge and Its Relevance to the Organization

3.1 Introduction

The main focus of this study is to examine a firm's absorptive capacity, i.e., a firm's ability to absorb (new) knowledge from its environment and to utilize this knowledge to commercial ends (Cohen and Levinthal, 1990). More specifically, this study is aimed at investigating the role of knowledge in the stimulation of innovation activities initiated by SMEs in the furniture and software sectors in Indonesia. We selected these two sectors because they both require specific knowledge in order to operate, whereas they possibly differ in their business approaches in dealing with this knowledge.

Knowledge plays a role in all kinds of business contexts and organizations. The employees of the furniture and software firms, for example, need 'know-what' and 'know-how' in order to complete their normal operations (Quinn, 1992). Based on the knowledge available in the firm, the nature of the business activities, and how they are managed and organized, organizations can be classified into two types: knowledge-intensive and non/less knowledge-intensive firms (Alvesson, 2004; Robertson and Swan, 1998). Knowledge-intensive firms (KIFs) are organizations in which most of the work is of an intellectual nature, and where well-educated, qualified employees form the major part of the workforce (Alvesson, 2004). Examples of KIFs are law and accountancy firms and engineering and computer consultancy companies. In this study, a software firm is considered as a more knowledge-intensive organization, whereas a traditional furniture manufacturing firm is regarded as a less-knowledge intensive business. So, as software firms meet almost all the aforementioned characteristics of KIFs, furniture firms do not. The workforce of furniture firms, for instance, does not necessarily consist of highly qualified individuals, while they have a lesser degree of autonomy in performing their tasks.

Many SMEs, especially in developing countries, are facing various problems in the development and expansion of their businesses. These problems include access to capital and markets (Nichter and Goldmark, 2009). In addition, many of them are not legally registered, while their accounting practices are insufficient, which is why they have no access to services provided by financial institutions (e.g., banks). Moreover, many of the SMEs mainly rely on the traditional market channels, which make it more difficult for them to utilize potential market opportunities and benefit from added marketing value. Some authors argue that the main problem of SMEs in developing countries is not their small size but their isolation, which especially hinders their access to export markets, knowledge, finance, and institutional support (Mead and Liedholm, 1998; Swierczek and Ha, 2003). In their study conducted among Indonesian manufacturing firms, Indarti and Langenberg (2004) argue that access to knowledge is considered to be a significant factor in business success. The more a firm has access to knowledge, the more successful it is likely to be.

Nowadays, knowledge is considered as the major form of input for economic processes and a crucial precondition for the possibility of firms, communities, and individuals to participate successfully in the global economy (Reich, 1991; Hollifield and Donnermeyer, 2003). Especially new knowledge stimulates business opportunities, serving as valuable input and output in economic activities, even in poor countries (Melody, 1985). Several studies indicate a significant effect of (new) knowledge on firms' survival and innovativeness (Rothwell, 1991; Kristiansen et al., 2005, as described in Chapter 2). These studies stress the need for and importance of an organization's absorptive capacity in relation to innovation, especially with respect to the role of external knowledge.

We have used the framework of knowledge transfer and the resource dependency theory to explain firms' behavior and need for external knowledge in producing innovative goods and/or services on a continuous basis. To give an illustration, due to the scarcity of teak-wood - an important raw material in the furniture sector - and the issue of illegal logging, a furniture firm needs knowledge about the use of an alternative type of wood. By obtaining this knowledge, the firm will be able to maintain its production process without any significant problems. Another example: for the production of customized software a computer firm needs to obtain knowledge from its buyers to define the user requirements for information systems. To this end, it will need up-to-date information on the buyers' needs and preferences. Other types of firms may obtain such knowledge from other resources, such as research institutions, government offices, and media exposure. The existence of external knowledge,

its importance for firms, and especially the interaction of firms with other organizations will be discussed in more detail in Chapter 4.

As opposed to the larger firm, a SME is often administered by only one person (also known as a "one man show"), for example by the owner or manager of the business (Stanworth and Curran, 1976). Consequently, all initiatives and decisions with respect to acquiring and utilizing new external knowledge are taken by this entrepreneur. Additionally, SMEs generally do not have a special business unit for innovation, such as the R&D department in large firms (Tidd et al., 2005). According to Romijn (1999), this is a *fortiori* the case in small organizations that do not have the resources and organizational capabilities to set up R&D facilities (Romijn, 1999; Romijn and Albaladejo, 2000).

Furthermore, compared to businesses in developed countries, firms in developing countries lack the technological skills and resources to adopt a successful approach to internal knowledge development (Tsang, 1999; Narteh, 2008). This is why the interaction with their foreign partners (from the developed countries) is important in enabling them to leverage their knowledge basis to enhance their operational excellence (Freeman and Hagedoorn, 1994). In the context of SMEs in developing countries it is therefore relevant to focus on the management and organization of knowledge. This is called the institutional level of knowledge, while on the individual level one speaks of the individual as the carrier of knowledge. In this study, we will deal with knowledge on both these two levels. The following sections concentrate on this issue in more detail.

This chapter begins with a discussion of the general concept of knowledge, which can be distinguished into data and information. How knowledge is viewed from the organizational level is described in Section 3.3. Further, knowledge as a key organizational resource is discussed from two perspectives: the resource-based and the knowledge-based view. Section 3.4 describes knowledge management, followed by a discussion about knowledge from the individual perspective in Section 3.5. Subsequently, the stickiness of external knowledge and its properties are dealt with in Section 3.6. Finally, we will give conclusion.

3.2 Knowledge in General

Knowledge is an important source in a firm's continuation and growth (Roberts, 1998; Civi, 2000; Carneiro, 2000), because it enables the organization to introduce new products/processes/services and/or improve its current products/processes/services more efficiently and effectively (Nonaka et al., 2000). To many firms, (new) knowledge is the life-line in their search for

innovation (Van Daal et al., 1998), enabling them to take organizational action aimed at renewal (Inkpen, 1998), which is critical for their long-term survival (Civi, 2000). With respect to its operational and strategic processes this implies that a firm's attention and decision making should be primarily focused on knowledge (Roberts, 1998).

Knowledge differs from information and data. Data can be defined as raw numbers, images, words, and sounds that are the result of observation or measurement (Hislop, 2005). The raw numbers from a marketing survey, for instance, can be used as a basis for making calculations or drawing conclusions. Generally, data are available in a form that is suitable for computer storage or processing. Information consists of data arranged in a structured pattern or meaningful order (Mitchell, 2000). For example, in order to obtain specific useful information the raw data from a marketing survey could be analyzed by means of a particular statistical technique.

Knowledge, however, is information combined with experience, context, interpretation, reflection, and perspective (Davenport et al., 1998), and adds a new level of insight and meaning (Frappaolo, 1997). Meaning, in turn, is attached and linked to existing systems of beliefs and bodies of knowledge (Hislop, 2005). In short, knowledge is information which is interpreted and evaluated. This is in line with Nonaka et al., (2000), who argue that knowledge is dynamic: "knowledge is essentially related to the human mind". Therefore, knowledge is generated through a process of reasoning, interpretation, and adaptation initiated by someone who has received data and information (Jorna, 2006). This implies that knowledge can only occur in the minds of people, which means that it is a cognitive process. "People possess cognitive structures for perception, interpretation and evaluation. Perception produces data for interpretation. Interpretation entails the production of meaning, which transforms data into information, by fitting it into a stock of knowledge. Understanding connects and transforms information into beliefs or claims of causal or deductive insight. Knowledge is a meaningfully ordered stock of information (interpreted data), and understanding, plus the ability to transform it into actions (skill), which yields performance." (Nooteboom, 1996:8). In brief, knowledge is the interpretation of information by a beholder who uses his/her own history, experiences, and interpretation schemes. This is why the interpretation of the same information by different people can result in different knowledge contents (Jorna, 2006). As Weggeman (1997) – cited in Uit Beijerse (1999:99) – notes, "knowledge is personal capacity that should be seen as the product of information, the experience, the skills, and the attitude which someone has at certain point in time."

So knowledge can be viewed from an individual perspective. Here the individual is considered to be the carrier of knowledge. As an illustration, an employee who works in a software firm has specific knowledge and experience in the field of software development and related technologies. S/he has gained knowledge from her/his experiences by going through a process of perception, interpretation, and evaluation. Another example refers to the interpretation of knowledge. When observing the process of making a certain model of a chair, an employees' interpretation of his/her observations will lead to an understanding of this process. Insight will be gained into why the wood is cut and connected to other parts in a specific way. This understanding will enable the employee to imitate the various steps and eventually improve them on the basis of his/her evaluation of the initial process. In short, the knowledge possessed by an individual (as the carrier of knowledge) may be of such a nature that it can be absorbed by a receiver, in this case a firm's employee. Section 3.5 will further elaborate on this issue.

Aside from knowledge at the individual level, there is also organizational knowledge. This kind of knowledge is stored in the collective memory of the employees of an organization and forms the basis of the firm's routines, procedures, and customs. Organizational knowledge consists of the applied knowledge of all individuals within a business in combination with the organizational data and information stored in machines, computers, and other items (Nelson and Winter, 1982). In addition, it can be obtained via both internal and external sources. A firm can be considered as a collection of people (Davenport and Prusak, 1998) who function as human information-processing systems (Jorna, 2006). Hence, the usefulness of the knowledge is determined by the perception, interpretation, and understanding of these human information processing systems.

3.3 Knowledge and Its Value to the Organization

It has been argued that to the majority of organizations knowledge is extremely important (Davenport and Prusak, 1998). As mentioned earlier, a firm or an organization is viewed as a collection of individuals (actors) who have the ability to achieve commercial ends on the basis of their knowledge. This implies that the term organizational knowledge refers to the aggregate knowledge of employees within an organization. Generally, organizational knowledge is embedded in the organization in the form of documents or repositories, such as manuals and descriptions of organizational routines, processes, practices, and norms (Davenport and Prusak, 1998).

From a slightly different point of view, Winter (1988) describes a firm as an organization that knows how to do things, which implicitly indicates that

knowledge plays an important role. Obtaining a better picture of the role of knowledge within organizations, especially the way in which organizations generate and pass on knowledge, may increase our understanding of why some firms are consistently successful.

3.3.1 Knowledge as a key organizational resource

Processing knowledge is central to business success (Prahalad and Hamel, 1990; Drucker, 1998). Similarly, a firm's internal knowledge and its capability to create exclusive knowledge form the centre of the theoretical perspectives on business organizations (Spender, 1996). In the literature on strategic and knowledge management, there are at least two theories dealing with knowledge as a firm's strategic resource: the resource-based and the knowledge-based theory. They will be discussed in the following section.

3.3.1.1 Resource-based view

The resource-based theory has been developed to understand why firms differ and how they operate by making use of their productive resources (Penrose, 1959; Barney, 1991; Wernerfelt, 1984). This theory starts from two basic empirical generalizations: (1) there are systematic differences among firms in the extent to which they control the resources necessary for implementing their strategies and (2) these differences are relatively stable (Foss, 1997:4). Furthermore, Foss (1996) argues that these two generalizations combined with fundamental assumptions - which are to a large extent derived from economics, determine the structure of the resource-based perspective. These assumptions are that (1) differences in firms' resource endowments cause performance differences, and (2) that firms seek to increase their economic performance. From this perspective, the main objective of the resource-based theory is to explain and account for the realization, continuance, and renewal in terms of resources (Foss, 1997:4). In line with this argument, Barney (1991) states that a firm is made up of bundles of resources, which determine its strength.

According to Penrose (1959) a firm can be considered as a collection of productive resources. A firm's resources consist of "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm which enables it to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney, 1991:101). Resources[7] form the input for a firm's production process, while the organization's capability refers to its capacity, what it can do, as a result of various teams of resources working

[7] Peng (2008) follows leading resource-based theorists such as J. Barney, Collis, and Montgomery and uses the term 'resources' and 'capabilities' interchangeably.

together (Grant, 1991). Generally, in the organizational context resources can be classified into two types, namely tangible and intangible resources (e.g., Barney, 1991, Grant, 1991, Collis and Montgomery, 1995; Haanes and Lewendahl, 1997). *Tangible resources* consist of (financial assets e.g., a firm's cash), physical assets (e.g., a plant, machinery/equipment), technological assets (e.g., patents), and organizational assets (e.g., evaluation and control systems). *Intangible resources* generally include human assets (e.g., experience and knowledge of employees, managerial skills), innovation and creativity (e.g., technical and scientific skills), and reputation (e.g., brand name).

Firms possess various types of resources which enable them to achieve their commercial objectives in an efficient and effective way. More specifically, these resources are the instruments that can be used to conceive of and implement organizational strategies (Porter, 1981). The resource-based theory defines several criteria for realizing competitive advantage. Barney (1991) proposes a VRIO framework to describe the most important criteria for resources. These criteria relate to the issues of value, rareness, inimitability, and the organization of a firm. A resource is considered as valuable if it helps the organization avoid an external threat or exploit an opportunity. A resource or capability should be fully used by an organization to take complete advantage of it. A resource is rare if it is not widely possessed by other organizations. A resource is inimitable and non-substitutable if it is difficult for another firm to acquire it or replace it by a substitute. Finally, the question of organization refers to how a firm is organized to develop and leverage the full potential of its resources and capabilities.

In addition, Wernerfelt (1984) states that the types and quality of resources can be considered as a firm's strengths or weaknesses. Wernerfelt (1984) presents the concept of resource position barriers which particular resources are attractive to firms. Resource position barriers are only partly analogous to entry barriers. Like entry barriers, they protect firms against other resource holders. Note that, in the traditional market context, entry barriers only control the relationship between incumbents and potential entrants. Resource position barriers, however, are particularly aimed at controlling the incumbents. Through its resource position barrier, another firm will have an advantage over others, thereby increasing its returns potential.

Wernerfelt (1984) also argues that most resources can be used in the production of several goods and/or services. Accordingly, a given resource position barrier has an influence on various products and assets; each resource yields part of the resulting return, for example, managerial skills. More specifically, Wernerfelt (1984:75) states that "firms need to find those resources which can sustain a resource position barrier, but in which no firm currently has one, and where

they have a good chance of being among the few who succeed in building one. They have to look at resources which combine well with what they already have and in which they are likely to face only a few competitive acquirers." This means that resources and their use lead to innovation.

In conclusion, the resource-based perspective considers firms as highly varying collections of both physical and intangible assets and capabilities (Collis and Montgomery, 1995). And only resources which meet certain criteria (i.e., VRIO framework) can serve as beneficial to the organization. In addition, the resource-based view recognizes knowledge as an intangible key resource which drives firms' performances (Barney, 1991; Collis and Montgomery, 1995).

3.3.1.2 Knowledge-based view

According to the 'knowledge-based theory, which builds on the resource-based perspective, firms are knowledge-creating entities. This view considers knowledge as an organization's most strategically significant resource (Nonaka, 1994; Kogut and Zander, 1992; Grant, 1996; Spender and Grant, 1996). The theory focuses on the role of the firm in the acquisition and creation of organizational knowledge. To understand this theory, Grant's discussion (1996:112) of this approach starts with two assumptions: "first, that knowledge creation is an individual activity; second, that the primary role of firms is in the application of existing knowledge to the production of goods and services." Grant argues that these two statements are in line with the role of an individual in creating and storing knowledge as supported by Simon (1991). Simon claims that "all learning takes place inside the individual human head; an organization learns in one of two ways: (a) by the learning of its members, or (b) by ingesting new members who have knowledge the organization did not previously have" (Simon, 1991:125). Additionally, Grant identifies the primary role of the firm as the integrator of knowledge of its members (i.e., individuals), which is transformed into goods and services through a series of business processes.

Further, Grant (1996) mentions three characteristics of knowledge integration which increase a firm's strategic value: efficiency, scope, and flexibility. The efficiency of knowledge integration is a function of the common knowledge, frequency, and variability of the tasks and structure which amplify communication. The scope of integration relates to the creation and integration of knowledge resulting in a firm's strategic value. The flexibility of knowledge integration is determined by the extent to which it adds new knowledge and reconfigurates the existing knowledge. From an external point of view, knowledge can also be obtained from the external environment through relational networks which span organizational boundaries (Grant, 1996; Kogut and Zander, 1996). These networks are efficient mechanisms for accessing and

integrating new knowledge, while they are especially useful in highly dynamic environments where the speed and scope of knowledge integration is crucial for the survival of the organization.

3.3.1.3 Summary of the resource-based view and the knowledge-based view

In conclusion, both the resource-based and knowledge-based theory emphasize the importance of a firm's resources, in particular knowledge, which is considered crucial for an organization's innovativeness and survival. A firm cannot develop and produce innovative commercial products as a proactive response to a highly demanding business environment without having access to comprehensive and renewed knowledge. Knowledge has a number of criteria (see Section 3.3.1.1). Firms that use knowledge as a strategic asset increase their chances of survival in the long run.

Internal knowledge increases a firm's operational processes and is of high strategic value to the organization. Given the resource-dependency theory's main point of departure, which is that firms cannot only depend on internal knowledge (as discussed in Chapter 2), both theories are required to obtain a basic understanding of the relevance of a firm's absorptive capacity. This is because apart from internal knowledge also external knowledge is highly important for a firm. It is, however, often difficult for firms to gain access to knowledge from the outside. In other words, from the perspective of the recipient, external knowledge is not easy to obtain or absorb. The phenomenon of problematic knowledge transfer and absorption is called the stickiness of knowledge (Szulanski, 1996; Von Hippel, 1998). Section 3.6 discusses the stickiness of knowledge in more detail.

In the context of this research, the stickiness of knowledge is dealt with from the point of view of the receivers, in our case a number of furniture and software firms in Indonesia. Our particular focus has therefore been on how these firms perceive and receive knowledge from external sources and utilize this knowledge to produce innovative outputs. In this respect, there are several ways in which firms can absorb knowledge. In short, the way in which firms manage their knowledge affects the benefits that may be gained. This concept is closely linked to the issue of knowledge management within organizations.

3.4 Knowledge Management

3.4.1 Defining knowledge management

Given the importance of knowledge as a strategic resource in the organizational continuation and renewal of businesses, the management of this knowledge is of particular interest (Civi, 2000). Not surprisingly, knowledge management has

become an increasingly important concept in today's business world, where firms have to cope with a constantly changing business environment.

Knowledge management is the process (Civi, 2000) through which firms create and use their institutional or collective sources of information. Similarly, Nonaka and Takeuchi (1995) define knowledge management as a process of applying a systematic approach in order to capture, structure, manage, and disseminate knowledge throughout the organization with the aim of increasing the work pace, reusing best practices, and reducing costly inefficiency, for instance by the standardization of project tasks. Another definition of knowledge management is proposed by Dalkir (2005) who includes the perspectives of knowledge capture, knowledge storage, and the valuation of intellectual assets. Her definition is the following:

> "Knowledge management is the deliberate and systematic coordination of an organization's people, technology, processes, and organizational structure in order to add value through reuse and innovation. This coordination is achieved through creating, sharing, and applying knowledge as well as through feeding the valuable lessons learned and best practices into corporate memory in order to foster continued organizational learning" (Dalkir, 2005:3).

Using these definitions as our point of departure, we define knowledge management as the process of managing organizational knowledge based on capturing, sharing, utilizing, and storing business information aimed at a more efficient execution of an organization's core processes.

Civi (2000:173) discusses the role of knowledge within the organization at various levels. At the strategic level, knowledge is required as a basis for formulating the strategic decisions to cope with challenging business environments. Relevant knowledge, for instance, could pertain to customer preference trends in Europe and the United States, the availability of existing as well as alternative raw materials such as teak-wood and mahogany wood or illegal logging practices that treat furniture products from Indonesia. On the basis of information on these issues the furniture firms in our study could formulate their strategic plans for the future and determine which specific customers need to be targeted and what unique products have to be produced.

At the tactical level, the organization needs to identify and formalize its existing knowledge, acquire new knowledge for future use, classify this knowledge, and build a management information system for storing and retrieving purposes. Management information systems enable organizations to structure the knowledge effectively and efficiently, on the basis of which they can make

proper decisions. For instance, by means of inventory information systems organizations can monitor the availability of raw material and finished products.

At the operational level, knowledge is used for daily business operations. Many firms use relevant technical knowledge, for example about how to preserve wood, how to assess wood quality, and how to make a certain piece of furniture. In the software business context, technical knowledge may refer to information on issues such as programming languages, database design, and computer network design. Technical knowledge is helpful in ensuring an effective production or development process.

The main aim of managing knowledge in the sense of constantly improving the way in which information can be shared within the organization, is to increase the firm's performance on a continuous basis. Particularly important in this respect is making sure that the organization has access to the right knowledge at the right time and place. Effective knowledge management is one of the components of good management. Other examples are formulating good plans, producing high-quality products, and paying more attention to customers. Davenport et al. (1998) claim that the success and failure of competing firms is determined by the effectiveness of their knowledge management.

3.4.2 Knowledge life cycle

As discussed in Chapter 2, in order to strengthen its innovativeness – as an indicator of absorptive capacity – a firm needs to absorb relevant external knowledge from various external sources. Before it is fully utilized by the firm, the external knowledge will go through several stages. In the case of furniture firms, for example, before designing and producing a piece of furniture, first knowledge regarding the buyers' preferences is processed. Similarly, the requirements for making certain software, which have been identified by the firm via various sources of knowledge, first have to be processed during several stages before the product can be actually developed.

In order to obtain a better insight into how knowledge is managed effectively within the organization, various functions of knowledge will be discussed. We have adopted an integrated framework, called the knowledge life cycle (KLC), developed by McElroy (2003). This knowledge life cycle is depicted in Figure 3.1. The KLC is a generic representation of the self-organizing patterns which people within organizations form as they engage in learning and problem solving. In other words, the KLC is a representation of social knowledge processing (McElroy, 2003).

In the business context, employees apply the knowledge present in the organization in their day-to-day tasks and routines (McElroy, 2003). Their

activities can be considered as "knowledge in use" or procedural "know-how", informed by declarative, "know-what" knowledge (Quinn, 1992). The knowledge in use is embedded in the specific organizational routines and operating procedures as understood by the members of the organization, who share a common experience and values (Lam, 1997:977). The knowledge in use in the organization, which can be considered as a business-processing environment, yields both "expected" and "unexpected" outcomes. The expected outcomes reinforce the existing knowledge, resulting in its reuse, whereas mismatches usually lead to adjustments to business-processing behavior via single-loop learning[8] (Argyris and Schön, 1978). In this context, the "expected outcomes" can be considered as indicators of the organization's innovation (see Figure 3.1). In short, absorbed external knowledge is relevant to the internal organization. In the context of software firms, for example, knowledge about a new programming language could be very important for the development of specific software. In the case of furniture firms, relevant knowledge may be new ways of preserving wood, which could be useful for the production of high quality long-lasting furniture.

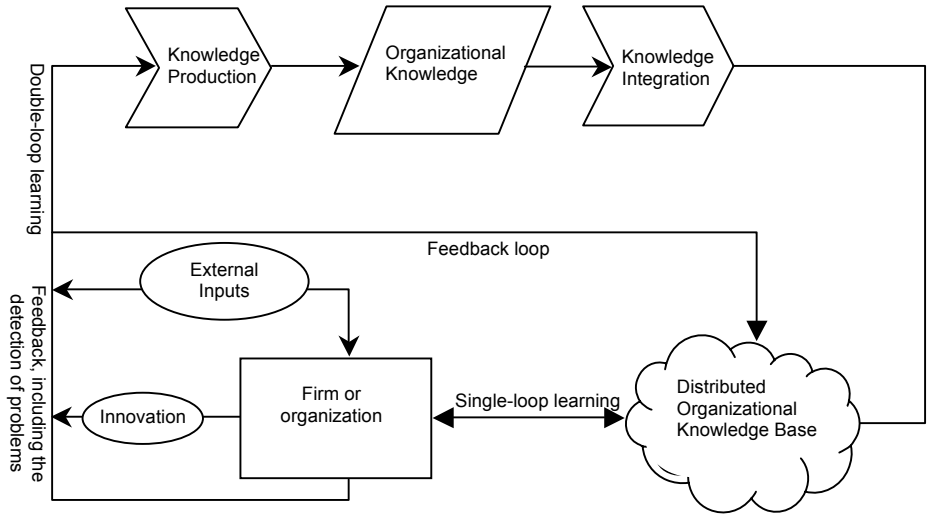

Figure 3.1. Knowledge life cycle as a framework for understanding absorptive capacity (based on McElroy, 2003)

[8] As stated in Chapter 2, a single-loop learning process is initiated when a firm detects errors and corrects them during the business processes in order to continue its present policies or to achieve its current goals without any modifications to the firm's underlying norms, policies, and objectives (Argyris and Schön, 1978:2-3).

On the other hand, when the outcomes are "unexpected", this means that the existing knowledge cannot sufficiently be used for creating innovative products. When the members of the organization detect an "unexpected outcome", they will try to solve the problem (see Figure 3.1). As a result, the existing knowledge will be rejected, after which new knowledge is being triggered, processed, and integrated via double-loop learning[9] (Argyris and Schön, 1978). This process is called knowledge capture and creation (Dalkir, 2005).

The learning process thus triggers an iteration of KLC, starting with problem detection and followed by problem formulation, knowledge production, and the implementation of an appropriate course of action to be integrated into the organization and its business processes via a range of sub-processes (McElroy, 2003). This trajectory includes all knowledge transmissions, such as teaching, knowledge sharing, and other social activities.

In the context of this study, the two main processes in building absorptive capacity are knowledge production and knowledge integration (see Chapter 2). In the case of knowledge production external knowledge is used as input, which is transformed into organizational knowledge, while knowledge integration means that the organizational knowledge is used as the input of various business processes to produce innovations. According to Dalkir (2005), knowledge integration is the process in which an organization introduces new knowledge into its operating environment (by means of knowledge sharing and dissemination) and retires the old knowledge.

In his framework, McElroy (2003) emphasizes that organizational knowledge is subjectively embedded in the minds of individuals and groups and objectively reflected in explicit forms. Knowledge is stored in the knowledge carrier (i.e., the human mind) and in common work practices or routines. In the context of SMEs, where the owner usually plays a very significant role (Stanworth and Curran, 1976), the knowledge carrier (i.e., the owner) becomes particularly relevant, especially because this person is primarily responsible for the realization of the firm's innovations, continuation, and interaction. Although the KLC puts the focus on large companies, it also discusses knowledge at the level of the individual as a carrier of knowledge which in some extents will be relevant for the context of SMEs in which the role of individual is very important. Here, knowledge acquisition, knowledge claim formulation, organizational learning, and knowledge claim validation are often practiced at the same time (Tidd et al., 2005).

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[9] See number footnote no. 1. When essential modifications are required, the firm is said to be going through a double-loop learning process (Argyris and Schön, 1978:2-3).

The KLC framework mainly illustrates the process by which an organization seeks and acquires (new) knowledge created by others, usually external knowledge, which is called knowledge acquisition. In addition, this framework only implicitly explains the integration of (new) knowledge created by external parties, which forms the basis of the realization of commercial outputs. In the context of this study, this ability is referred to as absorptive capacity (see Chapter 2). Interaction within and among firms also plays a role here, which is an important stimulating factor with respect to a firm's absorptive capacity. Chapter 4 will further address the issue of interaction.

3.5 Knowledge and Its Value to the Individual

As Nonaka and Takeuchi (1995) argue, knowledge is embedded in the mind of the individual. Hence, with respect to the optimum use of knowledge, the role of the individual as the carrier of this knowledge is important. From a cognitive perspective, an individual has the ability to perceive, interpret, and evaluate acquired knowledge (Nooteboom, 1996; Jorna, 2006), as discussed in Section 3.2. Hence, as a firm is a collection of individuals, it is relevant to focus on knowledge at an individual level as well as on the knowledge transfer among individuals. In the context of SMEs, the role of the individual (the owner) is essential and determining.

Two aspects are relevant to be discussed, i.e., (a) knowledge about certain domains, fields, and tasks; and (b) the way in which this knowledge is presented. In the subsequent parts, we will refer to the former as knowledge contents/domains and to the latter as knowledge types.

As mentioned previously (see Chapter 2), the communication theory, e.g. Shannon and Weaver (1949) and Berlo (1960), generally describes the process of communication in the framework of knowledge transfer from one firm to another. For example, a communication process between a furniture firm and its buyers takes place in the following way. A buyer (sender) sends a specific order (message) to the furniture firm (receiver) per email (channel). Another example: a software firm (i.e., the owner of the firm) gets a specific order (e.g., to make a new inventory-record system) via various channels, such as a face-to-face meeting or by telephone. In this context, the specific order is viewed as a message (containing knowledge) of which its characteristics (i.e., content and type) influence the ability of the firm (the receiver) to absorb its content (knowledge). In the following subsections, the two characteristics of knowledge will be elaborated in more detail.

3.5.1 Content of knowledge

Knowledge content represents what the knowledge is about; it can be domains, fields, and disciplines (Jorna, 2006). This characteristic is concerned with the topic of the knowledge (Van der Spek and Spijkervet, 1997). The field of management is an example of a knowledge domain. Within this field there are several specializations, such as marketing, operations, human resource, and finance. In addition, there may be more narrow segments such as for example inventory control, scheduling, and quality control within operations management. This specialization may be contextualized in various types of businesses. Knowledge that is applied to a specific task is also called focal knowledge (Weggeman, 1996; cited in Mills and Goossenaerts, 2000). For instance, knowledge about operations is relevant to both software and furniture firms, but has different implementations. In the case of software firms, operations management ranges from software requirement analysis to implementation in an organizational context, while in the context of furniture firms, it varies from inbound logistics (i.e., wood) and wood preservation to the inventory of finished products. Each of these processes requires specific knowledge. Thus, the domain attribute involves a multilevel taxonomy (Holsapple, 2003).

In the context of this study, we adopted the value-chain model of Porter (1985) as our point of departure to classify the topics of knowledge. Knowledge contents can be categorized into those that are related to primary and to secondary process. According to the model, primary processes relate to what an organization produces, yields, and brings into the market or society. For instance, a software firm produces inventory-control system software or a furniture firm manufactures customized chairs and tables. In both examples, the firms need specialized knowledge of the respective domains for the execution of their primary processes – knowledge about programming languages in the case of the software firm and knowledge about the furniture's design and wood-processing methods in the case of the furniture firm. The structures and interrelatedness of the primary processes make up the organizational process, also called the secondary process (Porter, 1985).

To give an illustration, a manufacturing furniture firm may absorb knowledge regarding various domains from external parties. These domains may include marketing aspects and the production process. Knowledge content regarding marketing aspects includes customer preferences, furniture trends, promotion tactics, and pricing strategies. Knowledge content with respect to the production process includes wood processing treatment, wood-cutting systems, the drying process, the varnishing/laminating process, joinery, and glue-processes. A software firm may acquire specific knowledge about

supervision/management, which is more detailed. For instance, knowledge about how to setup remuneration systems, how to motivate employees, how to make a financial report and a taxation system, and how to apply bookkeeping techniques. Some firms need various general knowledge segments at the same time, while other firms may only need knowledge on a few topics, but in more detail.

Porter (1985)'s value-chain model was introduced to describe the basic and supporting organizational processes and functions of large firms. As an illustration, to produce a piece of furniture or software, a large organization has to execute several tasks, including the design of the product to be, maintaining the raw materials, setting up a specific type of production process, using technology/equipment to produce the product, and promoting the product on the markets as well as motivating the employees to maintain a high-quality production. In short, the organizational processes and functions involved in creating and developing a new product usually require many departments and employees (Tidd et al., 2005). However, in the context of SMEs this is not the case, since here the role of the owner is generally predominant (Stanworth and Curran, 1976; Tidd et al., 2005) and the knowledge domains needed to run the business are often not as complex as those used by large firms. However, although Porter's model was originally developed to analyze large firms, it is also suitable for understanding knowledge absorption at the level of SMEs, where the individual (i.e., the owner) has a central role.

Considering a categorization of the knowledge contents or domains[10] as used by Kristiansen et al. (2005), Porter's value-chain model[11] was simplified to adjust it to the context of small and medium firms, which resulted into six knowledge domains (see Figure 3.2), namely design/products, raw materials (resources), the production process, equipment/technology, markets, and supervision/ management. In this study, these domains will be explored in the context of the furniture and software sectors in Indonesia. The nature of the knowledge content/domain as one of the characteristics of knowledge may affect a firm's ability to absorb this knowledge. In addition, a particular source of knowledge may provide only one knowledge domain, while other sources supply several knowledge domains.

[10] The term 'content' or 'domain' is used interchangeably.

[11] The value-chain model will also be used to understand the mechanism of interaction and the connection chains or parties involved in the interaction (see Chapter 4).

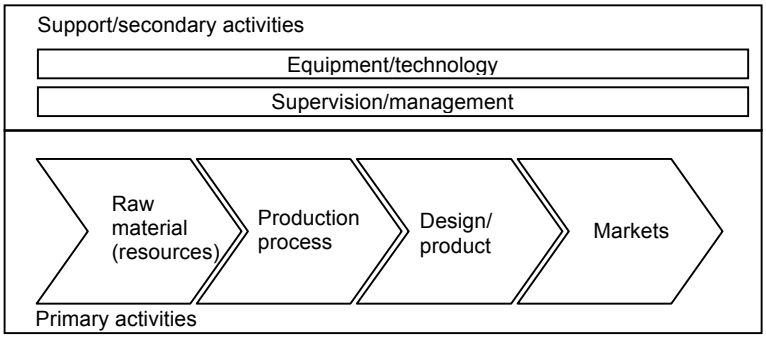

Figure 3.2. Value-chain and knowledge content (adopted from Porter, 1990)

3.5.2 Types of knowledge

In the knowledge management literature, types of knowledge have been classified in various ways. For instance, Polanyi (1962) has 'traditionally' classified knowledge into tacit and explicit knowledge, while Boisot (1995) has grouped it into coded and un-coded knowledge. As already indicated, the current study focuses on knowledge at the individual and organizational levels in the context of SMEs. Knowledge is embedded in the individual's mind (Nonaka et al., 2000). Since a firm may be considered as a collection of people (Davenport and Prusak, 1998) or as a collection of humans as information-processing systems (Jorna, 2006), knowledge of each individual in an organization can be regarded as organizational knowledge (Nelson and Winter, 1982, see Section 3.2). This line of reasoning implies a cognitive perspective on knowledge (see; Nooteboom, 1996; Jorna, 2006). Therefore, we have taken the cognitive perspective as our point of departure, using the types of knowledge as proposed by Cijsouw and Jorna (2003), namely sensory, coded, and theoretical knowledge. The following sections explain each type of knowledge used in this study.

3.5.2.1 Sensory/tacit knowledge

One of the most widely accepted dichotomies among the various types of knowledge is tacit knowledge versus explicit knowledge[12] (see Polanyi, 1962;

[12] Explicit knowledge – as the opposite type of tacit knowledge – refers to knowledge that is transmittable in a formal, systematic language (Polanyi, 1962). This type of knowledge is

1966). This dichotomy represents one of the earliest attempts to categorize knowledge (Jasimuddin et al., 2005). Tacit knowledge has originally been characterized by Polanyi (1962) as personal, context-specific, and therefore hard to formalize and communicate. This type refers to the knowledge which is embedded in the mind of the individual (Nonaka and Kanno, 1998) and which cannot be separated from this person. Since this knowledge is based on the background and experience of its carrier, it is highly personal (Roberts, 2000). Nelson and Winter (1982) argue that a large part of the human knowledge is context-bound, highly specific, and tacit in nature, and that there are limits to the degree to which it can be articulated and transferred. Similarly, Grant (1996) claims that if most of the knowledge (i.e., external knowledge) is tacit, the absorption of this knowledge and its transfer between/among organizational members is extremely difficult.

For instance, an owner of a furniture firm who has been running the business for many years is likely to have a lot of experience. S/he will possess a great deal of knowledge related to the business, from technical know-how, such as how to select good quality wood, to managerial knowledge, such as how to select suppliers or business partners. Another example is the knowledge possessed by a programmer in a software firm who develops computer-based information systems. The extensive personal experience of this employee is often not easy to transfer to other parties. This is because this type of knowledge is exclusively linked to its carrier and often not well-documented.

In addition to Polanyi, who uses the term tacit knowledge to characterize information which is difficult to express, Cijsouw and Jorna (2003) propose to divide tacit knowledge into sensory and theoretical knowledge[13]. Sensory or behavioral knowledge is knowledge of situations and events expressed in the form of behavior, procedures, and habits, which can be observed and imitated. Sensory knowledge is very dependent on its context, it diffuses slowly, and it is time-bound. As a characteristic, it cannot be expressed in words, only in behavior.

As an illustration, when a manager of a furniture firm participates in a training on quality and production management, s/he is given the opportunity to personally receive, observe and interpret information about quality control and

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expressed in concrete forms, such as words, numbers, hard data, scientific formulas, manuals, computer files, documents, patents, and standardized procedures, or universal points of departure that can be transferred, spread, taught, and trained.

[13] Knowledge that can be explained, although this is sometimes very difficult, is called theoretical knowledge (see Section 3.5.2.2).

production processes in the furniture business. After the training, the knowledge obtained can be used in the production and quality control processes of the manager's firm.

Furthermore, sensory knowledge can be categorized in terms of level of detail, depending on the degree of detail acknowledged by the recipient, into rough sensory knowledge and detailed sensory knowledge (Cijsouw and Jorna, 2003; Jorna, 2006). For instance, a software firm is asked to develop new software for educational purposes. When the manager of such a firm is experienced, s/he will be able to make a better estimation of the requirements for the development of this software in terms of time and resources, programming language, and level of difficulty. So it can be argued that this manager possesses detailed sensory knowledge. In contrast, for a manager whose knowledge of software technology is much more limited, it may be much more difficult to make the proper managerial decisions with respect to the development, time planning, and production of this software product. Since this manager only has a general and narrow understanding of the issue at hand, the knowledge s/he possesses is called rough sensory knowledge. From the perspective of the recipient, rough sensory knowledge is less accessible, and hence stickier. On the other hand, detailed sensory knowledge is more accessible, which makes it less sticky.

3.5.2.2 Coded knowledge

Knowledge can also be expressed in various kinds of codes. Coded knowledge includes the use of signs and symbols referring to objects or experiences (Jorna, 2006). By using coded knowledge it is possible to communicate and exchange information without the actual presence of the object to which this knowledge refers or even without the presence of the communicating actor him/herself (Jorna, 2006). For instance, we can talk about *tables* or *computers* without their actual presence. The code itself represents the knowledge.

According to Boisot (1995), coded knowledge is to a lesser extent tied to context than sensory knowledge. Coded knowledge is linked to the context of the code by means of language or a collection of pictograms (Jorna, 2006). Knowledge stored in a coded form is more transparent and accessible (Boisot, 1995), which makes its dispersion easier and quicker than that of sensory knowledge. Therefore, coded knowledge can be transferred quite easily within a community if its members know the codes (Jorna, 2006).

Coded knowledge may be represented by various kinds of symbols. These symbols may range from weakly- to strongly-coded, i.e., from icons or pictures, diagrams, schemes, to language/texts and formulae. Each representation has its own degree of ambiguity. A code is 'better' if it reduces ambiguity (Cijsouw and

Jorna, 2003:220). In other words: the weaker the code, the more ambiguity. For example, the knowledge represented in a programming language, which is strongly-coded and has a set of well-defined rules, is less ambiguous than the knowledge presented in icons. On the other hand, weakly-coded knowledge as presented by icons or pictures is more ambiguous and requires more interpretation, which makes it less accessible. This knowledge is hence stickier.

3.5.2.3 Theoretical/abstract knowledge

The last knowledge type used in this study is theoretical knowledge. Theoretical knowledge refers to the understanding of a structure or pattern of a concept (object, or event) (Cijsouw and Jorna, 2003). Understanding a concept implies that it can be explained and reasoned about; one is able to use its terminology correctly and to indicate its relations with other concepts (Cijsouw and Jorna, 2003).

People use theoretical knowledge when they answer why-questions. On the basis of this knowledge people are able to identify structural (Cijsouw and Jorna, 2003) as well as causal relations (i.e., if-then-relations). When the why-connection is simple, the theoretical knowledge is more concrete. So the more complicated the why-connection, the more abstract the theoretical knowledge. Theoretical knowledge is generally found among the well-educated owners/ managers of firms.

Theoretical knowledge can thus vary from concrete to abstract. The gradation of abstractness relates to the complexity and length of the causal chains (the why-chains) (Jorna, 2006). To give an illustration, a manager of a furniture firm has a face-to-face meeting with its foreign buyers to discuss the use of an alternative raw material, such as mahogany, for the firm's furniture production. During the meeting, the buyers explain why mahogany is more preferable. It appears that this wood type is often used by customers in countries with four seasons. During these kinds of informative meetings, abstract theoretical knowledge is transferred. According to Lam (1997), knowledge acquired through formal meetings/trainings tends to be more abstract and theoretical. The more complicated the why-connection or the causal relations, the more abstract the knowledge. It is therefore stickier.

Firms may perceive the various types of external knowledge in different ways. For example, according to firm A the knowledge provided by an external source may consist of 30% sensory knowledge, 35% coded knowledge, and 35% theoretical knowledge, while firm B may perceive the same information as 10% coded and 90% sensory knowledge. This could be explained by several factors, such as a firm's experience and the resources available to absorb the external

knowledge. In order to obtain a better understanding of the different perceptions of firms with respect to knowledge, we will discuss the interrelation between the various types of knowledge in the following section by presenting the concept of knowledge space (K-space).

3.5.2.4 Knowledge Space

As discussed previously in Chapter 2, knowledge transfer has become a key topic in the knowledge management research. Knowledge transfer is a goal-oriented approach to the sharing of knowledge across boundaries both within and among organizations. The process of knowledge transfer involves various types of knowledge and channels of transfer, which in their turn have an impact on the effectiveness of the process. Since all types of external knowledge require their own specific transfer channels, their identification is a highly relevant task.

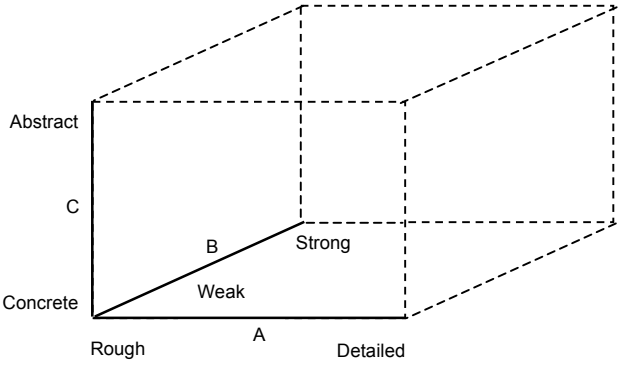

Figure 3.3. The knowledge space: knowledge type belonging to an individual (Jorna, 2006:87)

The knowledge space (K-Space) model introduced by Jorna (2006), which is based on Boisot (1995), is a framework that can be used to map the different types of knowledge as introduced above (see Figure 3.3). The K-Space is depicted by a three-dimensional cube that represents the types of sensory, coded, and theoretical knowledge. Sensory knowledge ranges from rough to detailed, while coded knowledge can either be weakly- or strongly-coded. Finally, theoretical knowledge ranges from concrete to abstract.

This space is a visualization in which the different types of knowledge appear simultaneously. In principle, there is always one dominant knowledge type (Jorna, 2006) in an organization with respect to a certain knowledge content. However, as pointed out by Jorna (2006), in reality, sensory, coded and theoretical knowledge are not in a clear-cut way divided among the actors who execute tasks. For example, theoretical knowledge can build upon coded knowledge, which in turn can build upon sensory knowledge, which means that even if the dominant type is theoretical, the other types (sensory and coded knowledge) are always present.

Knowledge in the K-Space is converted from one form into another form. It can be converted from rough sensory into detailed, or from sensory into theoretical knowledge. For example, the knowledge acquired by an owner of a furniture firm during an exhibition may be conceived as general and rough sensory knowledge. When the owner transfers the knowledge to the workers, s/he may convert it into detailed sensory or coded knowledge. Similarly, the owner of a software firm may be familiar with the specific software presented at an exhibition on the basis of his/her knowledge and experience, which is why there is no need to address the developer of the software for additional information. In this case, the knowledge is sensory. When developing similar software, the sensory knowledge is converted into theoretical or coded knowledge during the process of instructing the firm's personnel.

The K-space depicts snapshots of the knowledge of individuals (e.g., owner X and manager Y), which can be compared. Making a collection of these snapshots through time provides an overview that can shed light on the knowledge dynamics of an organization. In the context of this study, an individual is the owner/manager of a furniture or a software firm. Analyzing the K-space of the owner will result in a knowledge snapshot on an individual level. As the current study is particularly focused on knowledge management in the context of furniture and software SMEs where the individual owner/manager is responsible for the whole organization (Stanworth and Curran, 1976; Tidd et al., 2005), the analysis of a snapshot on the individual level will simultaneously provide us with insight into the organizational level.

The knowledge space can be interpreted as follows. Let us take the owners of two furniture firms as an example: Mr. X, who has been running his business for about 20 years, and Mrs. Y, whose firm has been operating for five years now. Considering the businesses' lifetimes, it may be obvious that Mr. X has more experience and knows more about the furniture business than Mrs. Y. Suppose that both of them participate in a workshop on successful business management. It is very likely that Mr. X and Mrs. Y absorb the knowledge presented to them

differently. Since sensory knowledge is dependent on its context, the experienced Mr. X, who possesses detailed sensory knowledge, may be better able than Mrs. Y. to interpret the new information – i.e., include how and why questions – concerning the key success factors in running a furniture business. In this regard, Mr. X has also more theoretical knowledge than Mrs. Y. During the workshop, both the owners are also provided with hand-outs and books. In this case, Mr. X will be better able to understand and absorb the coded knowledge, which is presented in writing, than Mrs. Y, because of his broader experience and more extensive knowledge. Based on the above explanations, Figure 3.4 schematically depicts the pattern of knowledge types associated with each individual. As already mentioned earlier, in this case, the knowledge-space of the owners can be considered as the knowledge-space of the entire organization.

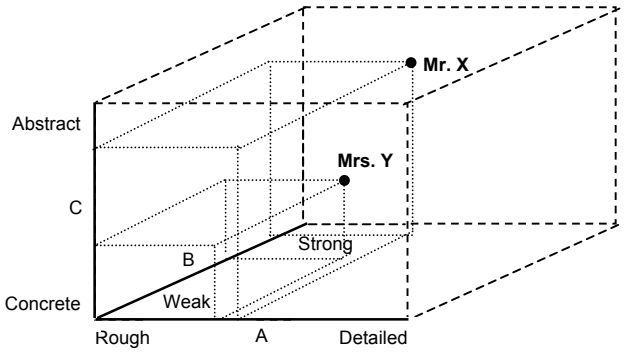

Figure 3.4. An example of a knowledge space divided between Mr. X and Mrs. Y

In this way, the K-space may provide a framework for analyzing flows and stocks of knowledge within organizations. The types of knowledge present in firms may change over time due to processes of conversion or the absorption of new knowledge. A knowledge type, which is dominant within a firm at a particular point in time, may be replaced by another type at another point in time. Additionally, as shown in the current study, the K-space is very useful in analyzing the behavior of the various organizational units (groups of people) with respect to acquiring, absorbing, and utilizing external knowledge (Boisot, 1998).

In previous sections, we already concluded that knowledge with its specific characteristics is the most important resource for businesses. When the existing knowledge within a firm does no longer suffice in the creation of innovations as a response to changes in the business environment, the firm will start focusing

on the absorption of external knowledge. The firm may obtain this knowledge from various external parties (e.g., buyers, suppliers) and sources (e.g., newspaper/magazines, television/radio, Internet).

Knowledge absorption/transfer from external sources can in some cases be influenced by various factors, for example which channels of transfer are used or which types of external knowledge are available. When knowledge is not easy to transfer or absorb, it can be labeled as sticky (Szulanski, 1996). The concept of knowledge stickiness will be discussed in the next section.

3.6 Stickiness of Knowledge

The stickiness of knowledge, or in other words the difficulties associated with the absorption and transfer of knowledge within a firm or among firms, has attracted considerable attention in the literature. We have used the framework of the communication process (e.g., Shannon and Weaver (1949); Berlo (1960) as explained in Chapter 2) as our starting point for understanding the process of knowledge transfer from one firm to another, and in particular to classify the properties of stickiness. The communication process theory (e.g., Shannon and Weaver, 1949) provides a model of knowledge transfer that can be used to understand the phenomenon of stickiness (Szulanski, 2000).

The process can be illustrated as follows. A furniture firm (i.e. owner of the firm), called the receiver firm, may obtain knowledge regarding products or markets (i.e., a message) from various sources of knowledge (i.e., buyers, suppliers, and competitors) via various channels, such as face-to-face meetings or technology-mediated communication. The sources of knowledge have certain characteristics (i.e., a reluctance to share the knowledge, a particular geographical location) which hinder the absorption/transfer of the knowledge. In addition, the receiver also has characteristics (i.e., lack of motivation, internal capacity) which impede the access to the external knowledge. In another case, the knowledge itself may have certain characteristics which make it less accessible to the receiver, for example because it is sensory, coded or theoretical as discussed in Section 3.5.2. The received knowledge may also be influenced by the channel used to gain access to it (this will be discussed in Section 3.6.2.2.)

As the main focus of this study is to examine how a firm manages knowledge from external sources (i.e., absorptive capacity) through various channels, we will pay specific attention to the characteristics of this knowledge, its channels, and their impact on the process of knowledge transfer/absorption. The next section discussed the stickiness of knowledge (i.e., knowledge from the external environment), including its definition and properties.

3.6.1 Defining stickiness

The concept of stickiness was initially used in macroeconomics as 'sticky prices' to express prices that were slow to adjust. From the neoclassical point of view, stickiness of knowledge is viewed in terms of money. Arrow (1962) defines stickiness of knowledge as costly to transfer. Correspondingly, Von Hippel (1994) defines the stickiness of a given unit of knowledge as the incremental expenditure or cost required to transfer that unit of knowledge to a specific site in a form usable to a given knowledge seeker. Von Hippel (1994) discusses the well-known path of resistance between a firm's research labs and its engineering department. In the strategy literature, sticky has been used as a synonym for inert (Porter, 1994) or difficult to imitate (Foss et al., 1995). Szulanski (1996) uses the term of 'internal' stickiness to indicate a firm's barriers to transferring knowledge (i.e., best practice) from one part of the organization to the other. In general, discussions about stickiness have primarily focused on the movement or absorption of knowledge inside a firm (Brown and Duguid, 2001).

However, in actual practice firms rely heavily on knowledge from the external environment (see the resource dependency theory in Chapter 2), but in some cases, it is not easy for them to absorb this knowledge. This may have several reasons related to the characteristics of knowledge (e.g., the incompatibility of knowledge types, see Section 3.5.1 and 3.5.2). In the context of this study, the concept of knowledge stickiness as introduced by Szulanski (1996, 2000) has been redefined. Rather than using the concept to explain the knowledge transfer among units within an organization, we have applied it to refer to the stickiness of knowledge exchange across organizations or between an organization and its (external) business environment.

The stickiness of external knowledge is a complex concept which can be approached from different points of view. In the context of this study, stickiness is addressed on the basis of two aspects, namely the characteristics of the knowledge and characteristics of its channels. Stickiness of knowledge refers to the degree of accessibility. Knowledge is considered as sticky if its accessibility is low. Accessibility is a multidimensional concept (Culnan, 1985). According to the Cambridge Advanced Learner's Dictionary, accessibility is the degree to which a piece of knowledge is easy to understand or reach. Culnan (1985) provides a definition which covers the physical access to the source, the interface to the source, and the ability to physically retrieve potentially relevant knowledge.

These definitions imply at least three kinds of accessibility, namely *cognitive*, *physical*, and *financial*. A piece of knowledge may be considered as sticky if it is difficult to be understood cognitively because, for instance, it is presented in

complex formula or in a foreign language, or located at a remote physical distance. A piece of knowledge that is costly to access may also be considered as sticky. The current study specifically emphasizes the cognitive and physical accessibility of external knowledge. It does not deal with its financial accessibility.

3.6.2 Properties of stickiness

Many scholars argue that the degree to which knowledge is sticky is related to the characteristics of the several actors and elements in the knowledge exchange process (i.e., Von Hippel, 1994; Szulanski, 1996; Ogawa, 1998), namely the characteristics of the sender, the characteristics of the receiver, the characteristics of the channel, and the characteristics of the knowledge itself. For instance, if small manufacturers in developing countries seek knowledge about technological solutions to particular production problems, they may be confronted with a certain level of stickiness due to the fact that the knowledge is very complex, the charges for getting access to it are high, and the distance to the locations where the knowledge is being developed (equipment manufacturers and knowledge institutes) is large.

In this study we consider the characteristics of external knowledge (i.e., content and type) and those of the knowledge channels as the main properties of stickiness. Each of these properties will be discussed in the following subsections.

3.6.2.1 Content of knowledge

As discussed in Section 3.5.1, knowledge covers various domains. In this study, we refer to the various domains of which the knowledge - provided by specific external knowledge sources - consists as the interconnectedness of knowledge (e.g., Simon 1976; Van der Spek and Spijkervet, 1997; Jorna, 2006).

In the case of a furniture firm, for example, the knowledge from buyers may simultaneously consist of knowledge about product design (e.g., a new design of a chair), the production process (e.g., a new method of preserving wood), and raw material (e.g., new coloring material). In the same vein, knowledge acquired from a governmental office may contain information on market demand. From the perspective of the furniture firm (the recipient), the knowledge obtained from the buyers has a higher level of interconnectedness than that provided by the governmental office, because it contains more knowledge domains. Therefore, the knowledge provided by the buyers has a higher degree of accessibility.

In the context of the software business, a software firm may both absorb knowledge about types of information systems from its competitor and retrieve

information on software products, language programming, and open source-systems from the Internet. From the viewpoint of the software firm, the knowledge from the Internet covers more domains and has therefore a higher level of interconnectedness than the knowledge provided by the competitor, which includes only a limited number of domains. The more knowledge domains transferred by a certain external knowledge source, the higher the degree of accessibility of this knowledge, and hence the lower its stickiness.

3.6.2.2 Types of knowledge

The K-Space three-dimensional cube in Figure 3.5 depicts the continuum of the degree of cognitive accessibility of each knowledge type (see Section 3.5.2), which is part of the focus of the current study. The accessibility of each type of knowledge is defined and explained as follows.

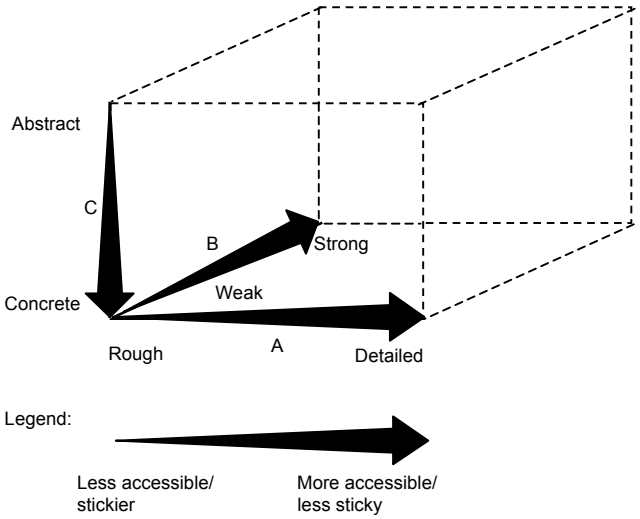

Figure 3.5. The knowledge space and stickiness

1. Sensory knowledge: rough and detailed sensory knowledge

As discussed in 3.5.2.1, rough sensory knowledge is more difficult to understand, which makes it less accessible than detailed sensory knowledge. An experienced business owner may perceive, understand, and interpret the knowledge provided at a workshop for wood preservation differently than a less-experienced entrepreneur. Since the level of detail of sensory knowledge is dependent on the recipient, in this case the experienced owner will perceive the information as

detailed sensory knowledge and the latter as rough sensory knowledge. From the perspective of the recipient, rough sensory knowledge is less accessible, and therefore stickier. Conversely, detailed sensory knowledge is more accessible, and hence less sticky.

2. Coded knowledge: weakly-coded and strongly-coded knowledge

Strongly-coded knowledge is more understandable and hence more accessible than weakly-coded knowledge (see Section 3.5.2.2). Strongly-coded knowledge (such as in formulae or scores) is easier to understand because it is less ambiguous. However, although this knowledge is more accessible and hence less sticky, it may take a lot of time to learn to understand it. On the other hand, weakly-coded knowledge (such as icons or pictures) is stickier because it is more ambiguous in that it requires much more interpretation.

3. Theoretical knowledge: abstract and concrete knowledge

As discussed in Section 3.5.2.3, abstract theoretical knowledge is more difficult to understand or access cognitively than concrete information. This type of knowledge consists of multiple causal relations, which also makes it stickier. Abstract theoretical knowledge may be easier grasped by an experienced manager because s/he has more business experience. Obviously, a less-experienced manager may have more difficulty in interpreting theoretical knowledge.

3.6.2.3 Channels

In this study, stickiness is also seen from the context of the characteristics of channels. Channels of knowledge transfer may differ in terms of their effectiveness. Many firms consider a face-to-face meeting as the most effective communication medium because the knowledge is transferred directly and is therefore easier to access and understand. Communication with the help of technology, such as telephone, may sometimes cause misunderstandings between the sender and the receiver because both parties cannot see each other's body language, which may lead to paradoxical communication (Bateson et al., 1956).

According to Heiman and Nickerson (2004:187), the degree of intensity of the communication among individuals (the physical distance) is determined by its bandwidth. For simplicity's sake, the authors only distinguish between high- and low-bandwidth channels. High-bandwidth channels involve tight, rich, and direct interfaces between partners, and are generally relatively costly in terms of time and effort. This case also goes to the context of SMEs in Indonesia, where in most cases, the buyers visit the firms to conduct their transactions.

The face-to-face meeting is designed to facilitate a higher level of social contact and directness of communication. Additionally, high-bandwidth channels

provide a high degree of interactivity, unambiguous contextual cues, possibilities for physical demonstrations, and a clear focus. These conditions make it easier for the receiver to capture the absorbed knowledge.

On the other hand, low-bandwidth channels, such as the telephone, letters, fax, and email are characterized as facilitating only low-context communications. This type of channel offers a low level of interactivity, ambiguous contextual cues, less clarity, practically no possibilities for physical demonstrations, and comparatively a less clear focus.

In addition to these two main types, nowadays firms have the possibility to get quick access to knowledge and to exchange this information with their colleagues or business partners by means of teleconferences. Teleconferences allow firms to conduct meetings even when the participants (for example, a firm's top management and its employees) are located at a remote distance from one another. This form of communication is a combination of the high- and the low-bandwidth channels. However in the Indonesian context, these kinds of interactions are very rare.

In this study, we distinguish the channels of knowledge transfer into two types: the traditional channel, referring to high-bandwidth communication and the non-traditional channel, referring to low-bandwidth communication (i.e., with the help of technology, such as the telephone, letters, facsimile, and email). The face-to-face meeting is a traditional channel of knowledge transfer. Firms may prefer this means of communication for various reasons, among other ones its practicality in social terms through the physical presence of the participants, and the directness with which these participants can exchange information.

In the context of stickiness, both the transfer and absorption of knowledge are more successful in the case of a face-to-face meeting because of the directness and extensiveness of the communication involved. The sender and the receiver are allowed to engage in an intimate exchange of information, enabling the recipient to receive the required knowledge in an effective manner. Through a process of immediate mutual (re)confirmation, the face-to-face meeting minimizes the risk of knowledge ambiguity and misunderstanding. This is not always the case when technology is used. A telephone conversation may in some ways be similar to a face-to-face meeting because there is a two-way communication line between the sender and the receiver, but this does not apply to email or facsimile. In general, it can be concluded that the traditional way of knowledge transfer is the best approach to obtaining an easier access to knowledge, and thereby to reducing its stickiness.

3.7 Conclusion

As discussed earlier, knowledge is considered to be an important resource with respect to the growth and survival of a firm. Knowledge can be analyzed on both the individual and the organizational level. The existence and importance of knowledge as a strategic resource in the context of a firm's survival have been conceptualized by using the resource-based and the knowledge based theory.

Due to several of its characteristics, (new) knowledge, especially from the external environment, appears to be difficult to absorb. We have labeled this condition as the stickiness of external knowledge. In this study, stickiness is viewed from the receiving firms' point of view (i.e., furniture and software firms in Indonesia), while we have especially focused on the three properties of stickiness, namely knowledge content (i.e., interconnected domains), knowledge types (i.e., sensory, coded, and theoretical) and the characteristics of the knowledge channels (i.e., traditional and technology-based). The current study is aimed at examining the relationship between the stickiness of external knowledge and the absorptive capacity (i.e., innovation) of firms in the furniture and software sectors in Indonesia. In addition, the types of knowledge absorbed within the context of Indonesian SMEs will be examined. Further, in order to obtain a more complete picture of the impact of the knowledge channels on the stickiness of the external knowledge as perceived by the furniture and software firms, we will particularly focus on its characteristics.

It is expected that the degree of stickiness of external knowledge as perceived by a firm will have an impact on the organization's absorptive capacity. Further, the absorptive capacity of the software firms (as more knowledge-intensive enterprises) is expected to be higher than that of the furniture firms (as less knowledge-intensive enterprises). Chapter 4 will further elaborate the aforementioned theoretical framework and the theories of absorptive capacity (Chapter 2) and interaction. This theoretical basis will then be used to formulate our research questions in more detail. Then the conceptual model and the hypotheses are presented in Chapter 5.

4. Interaction

4.1 Introduction

Interaction has a significant impact on a firm's success. Sorge and Warner (1987) argue that the success of a firm largely depends on the quality of its relations with other organizations. Interaction with other firms enables a firm to obtain resources, such as knowledge (i.e., know-how), materials, services, personnel, and capital, which are required to achieve its commercial goals and meet the interests of the external and internal stakeholders.

Interaction is a key element in the process of gaining access to, acquire, and develop (new) knowledge for the stimulation of a firm's activities in the field of innovation. Interaction with other firms enables organizations to absorb knowledge from external parties more effectively, and use it for creating new goods/services. Interaction can take place within a firm as well as between a firm and other organizations.

As discussed in the previous chapters (see Chapter 1 and Chapter 2), the interaction of a firm with other organizations can be explained by using the knowledge transfer framework (i.e., resource dependency theory and communication theory). The mechanism of interaction is triggered when a firm is in need of resources from the external environment in order to survive (Pfeffer and Salancik, 1978). From this perspective, the main reason for a firm to interact with other organizations is because it cannot solely rely on its internal resources, but also has to acquire additional external means to improve its capabilities and exploit opportunities. In order to realize its commercial objectives and expand its innovative activities a firm needs to acquire external knowledge through interaction with its environment, such as its buyers, its suppliers, and other parties involved. In this context, the knowledge transfer framework (i.e., communication theory) can be used to gain an insight into this process of interactive communication, consisting of the transfer of a message

(i.e., knowledge) by a sender to a receiver via various communication channels (i.e., traditional or non traditional).

This chapter discusses value chain analysis and social network theory. The value chain analysis offers a framework for understanding the mechanism of interaction and the connection chains with the external parties involved in the interaction, which are relevant to a firm's innovativeness (Porter, 1985). The social network theory discusses how the social structure (i.e., series of formal and informal ties) of relationships or interaction affects the spread of knowledge that in turn influences a firm's innovation policies (Granovetter, 1973). Hence, these two theories are relevant in obtaining a better understanding of the concept of interaction in its relationship with a firm's absorptive capacity (see Section 4.2).

This chapter starts with a discussion of the framework and the definitions of interaction. After that, we will deal with the importance of interaction for a firm's innovation activities and the parties involved in the interaction process.

4.2 Framework and Definitions of Interaction

The business literature offers various definitions of interaction. The Collins dictionary defines interaction as a 'mutual or reciprocal action'. Here interaction refers to a continuous two-way transfer of information between two parties who have a close relationship with one another. Wagner (1994:8) defines interaction as reciprocal events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another. From another perspective, (social) interaction is defined as the acts, actions, or practices of two or more people or organizations mutually oriented towards each other's selves, that is, any behavior that tries to affect or take account of each other's subjective experiences or intentions (Rummel, 1976). Furthermore, interaction is not defined by type of physical relation or behavior, or by physical distance, but it is a matter of a mutual subjective orientation towards each other (Rummel, 1976). The essential idea of interaction is a two-way effect as opposed to a one-way causal impact. In the various sciences interaction has differently tailored meanings. These definitions attempt to capture both the interaction among individuals or organizations and that between individuals and organizations.

From a sociological perspective, Granovetter (1973, 1983) introduced the network concept to describe interaction. A network is a set of relationships. More formally, it contains a set of objects (in mathematical terms, nodes) with a

map or description of the relations among these objects or nodes[14] (Granovetter, 1973). Granovetter (1973, 1983) is best known for his work on social network theory, especially the spread of information in social networks. A social network is defined as a series of formal and informal ties between the central actor and the other actors in a circle of acquaintances (relationships). In other words, social network theory is the study of how the social structure of the relationships of a person, group, or organization affects beliefs and behavioral patterns. These relationships may concern the feelings people have for one another, the exchange of information, or more tangible aspects, such as goods and money.

Van Aken and Weggeman (2000) call this network emergent network, which is not created by deliberate actions, but emerges organically from frequent and satisfying business transaction between organizations and by personal interaction between organizational representatives. Dyer (1996) argues that spatial and cultural proximity plays an important role in the formation of the informal network. In a developing country like Indonesia where collectivism culture (Hofstede, 1991) is dominant, relationships with other parties more frequently occur in an informal way. This informal network built upon this frequent interaction with enable a firm to absorb relevant external knowledge and may involve informal communication networks. Aalbers et al. (2009) define informal communication networks as the contacts actors have with others within the organization that are not formally mandated, include friendships with co-workers, but also contacts unrelated to the day-to-day workflow.

By mapping out these relationships, network analysis helps uncover the informal communication/interaction patterns existing within an organization, after which they can be compared to the formal communication/interaction structures. These patterns can be used to explain various organizational phenomena.

One of a social network's fundamental principles is that its participants share a greater homogeneity in terms of behavior, opinions, information, and ideas than other groups of people (Burt, 2004). Individuals connected across different groups are more familiar with alternative ways of thinking and behavior, which gives them a larger spectrum of options to select from and to synthesize. Hence, individuals who are positioned near the holes[15] in a social structure are more likely to come up with good ideas (Burt, 2004). This argumentation is derived from the theory of structural holes (Burt, 1992:2), which studies the way in which individuals, particularly within organizational settings, can fill the 'holes' between people or groups that are not interacting with one another. Such holes

[14] Examples of objects or nodes are people, firms, agents, and actors.
[15] Holes are buffers, like an insulator in an electric circuit (Burt, 1992).

can be entrepreneurial opportunities for gaining access to information, timing, referral, and control, which provide individuals with opportunities for building bridges by linking disparate people or groups who are not interacting with each other. A firm's survival as the result of its innovativeness is closely related to its access to holes (Burt, 1992; 2004).

More specifically, Granovetter (1973:1361) mentions four dimensions in (personal) networks which characterize the strength of the tie. These include amount of time, emotional intensity, intimacy (mutual confidence), and reciprocal services. In addition, Gilsing and Nooteboom (2006) propose a modified version of the dimension of tie strength, namely the scope of a tie. The scope of a tie may refer to width, depth, content of knowledge, frequency of interaction, and duration of the relationship.

Based on the discussion above, we have defined interaction in the context of this study as the intensity of contacts (i.e., the frequency of interactions) among communication partners created by the transmission and exchange of messages (i.e., knowledge) through time and space, both directly and indirectly. One speaks of direct interaction when the firm is able to access knowledge directly through interactions with the producer of this information (i.e., personal face to face contact), while indirect interaction takes place when there is no direct exchange of information with the producer of the knowledge, but via certain media (e.g., exhibitions, mass and electronic media) or knowledge repository (e.g., Internet).

As stated earlier, interactions can occur among people within a firm and between an organization (as a group of people) and its environment. This study focuses on the latter: the interaction between a firm and its external environment (external parties) aimed at absorbing knowledge necessary for enhancing the organization's innovativeness (i.e., absorptive capacity).

As discussed in Chapter 2, the knowledge transfer framework has been used to explain a firm's need for absorptive capacity (i.e., the resource dependency theory) and the related process (i.e., the communication theory). Knowledge transfer is considered as a basic element in the stimulation of a firm's innovativeness as an indicator of absorptive capacity. A firm's ability to produce innovative outputs relies on the process of knowledge transfer/absorption from relevant external parties as the sources of this knowledge. In addition, knowledge transfer occurs in every instance of interaction. Each interaction consists of a process of various ways of transmitting and exchanging knowledge between one firm and another. Knowledge absorbed from this interaction determines a firm's ability to realize innovations in a variety of areas (i.e., developing new products/services, entering new markets, and improving the

production, the marketing, and the management process) (Nooteboom, 2004). Hence, examining how the interaction with other parties impacts a firm's performance is relevant. Section 4.3 presents a detailed discussion of the importance of interaction for a firm's absorptive capacity.

In this study, we have used the value chain analysis as introduced by Michael Porter (1985, 1990). Some adjustments were made to adapt the framework to the situation of SMEs. Porter (1990:36) argues that every firm is a collection of activities that are performed to design, produce, market, deliver, and support its products. Such activities may include purchasing raw materials, manufacturing the products, as well as distributing and marketing them (Lynch, 2003). These tasks are classified into two main types: primary and secondary activities. Primary activities are tasks related to production, while secondary activities include supporting/managerial tasks which provide the basis for the effectiveness and efficiency of the firm, such as human resource management (see Chapter 3). In order to ensure that each activity is properly carried out, relevant supportive knowledge is needed[16].

Furthermore, the value chain consists of value activities and margin[17]. Value activities are the building blocks used by a firm in creating a product valuable to its buyers or external parties. Although value activities form the foundation on which a firm can build its superiority, the value chain is not a collection of activities. The value chain framework is "an interdependent system or network of activities, connected by linkages" (Porter, 1985:41). When the system is managed effectively, the linkages can serve as vital instruments in safeguarding a firm's survival (Porter, 1990; Pathania-Jain, 2001).

As already mentioned, the value chain encompasses the full range of activities from developing and manufacturing a good/service to its sale in the final market. In order to secure important resources (i.e., knowledge) the chain contains various external parties (called stakeholders) (Freeman, 1999). In the traditional model, firms only address the needs of buyers, while during the process of converting inputs into outputs, their activities are mainly focused on suppliers, buyers, and investors. However, the stakeholder theory argues that there are various parties that affect or can be affected by the actions of the business as a whole (Philips et al., 2003). These parties can be classified into primary and secondary stakeholders. The primary stakeholders are those who

[16] In this study, we have indicated the various aspects of the knowledge domain by means of the value chain: product/service, raw material, production process, technology/ equipment, marketing and management (see Chapter 3 Section 3.5.1)

[17] Margin is the difference between the total turn over and the collective cost of performing the value activities (Porter, 1990).

are engaged in the organization's economic transactions, such as employees, customers, and suppliers. The secondary stakeholders are not directly engaged in direct economic exchanges with the business, but can affect the organization or can be affected by it, such as government offices, business associations, communities, universities and the media. Even competitors are sometimes considered as stakeholders.

From an empirical point of view, Smeltzer et al. (1988) distinguishes knowledge sources into 1) personal and 2) impersonal sources. Personal sources are classified into informal and formal agents. Informal sources are family, employees, customers, competitors, and friends/consultants; while formal sources include bankers, lawyers, and accountants. Impersonal sources are divided into written and oral means. Written sources include magazines, newspapers, books and catalogues, while examples of oral sources are trade shows and seminar workshops. In a study conducted among the owners/managers of small firms in Phoenix and Kansas City, Smeltzer et al., show that personal information is more valuable than impersonal information, and that informal personal information is considered the most valuable of all (Smeltzer et al., 1988). The study explains that the owners of small firms tend to gather their information from people with whom they interact on a frequent basis. Fann and Smeltzer (1989) have found that accessible information is used more frequently than information which is less easy to come by.

As regards place of origin, Van Geenhuizen and Indarti (2008) categorize knowledge sources into two types: "mainly local origin" and "mainly global origin". The first type (local origin) includes buyers, suppliers, competitors, and friends/neighbors, while the second (global origin) refers to industry associations, exhibitions, magazines/newspapers, television, radio, and the Internet. In general, Van Geenhuizen and Indarti (2008) have found that small furniture firms in Jepara (Indonesia) make less frequently use of knowledge of "global origin" than knowledge of "local origin".

Based on the concept of stakeholders, the nature of interaction, and the previous studies (e.g., Smeltzer et al., 1988; Van Geenhuizen and Indarti, 2008), we group the various parties into three categories according to the nature of their interaction, especially regarding the relevance of the knowledge which they bring into the firms (i.e., furniture and software): direct individual, direct institutional, and indirect sources of knowledge (see Figure 4.1). Buyers, suppliers, competitors, and consultants are considered as direct individual sources of knowledge, since the interactions between the firms and the parties are direct and – in the context of Indonesian SMEs – they take place individually rather than institutionally. Government offices, industry

associations, religious affiliations, and research institutions/universities are included as direct institutional sources, while exhibitions and the media as represented by magazines/newspapers, radio, television, and the Internet are considered as indirect sources of knowledge. Each of them will be further elaborated in Section 4.4.

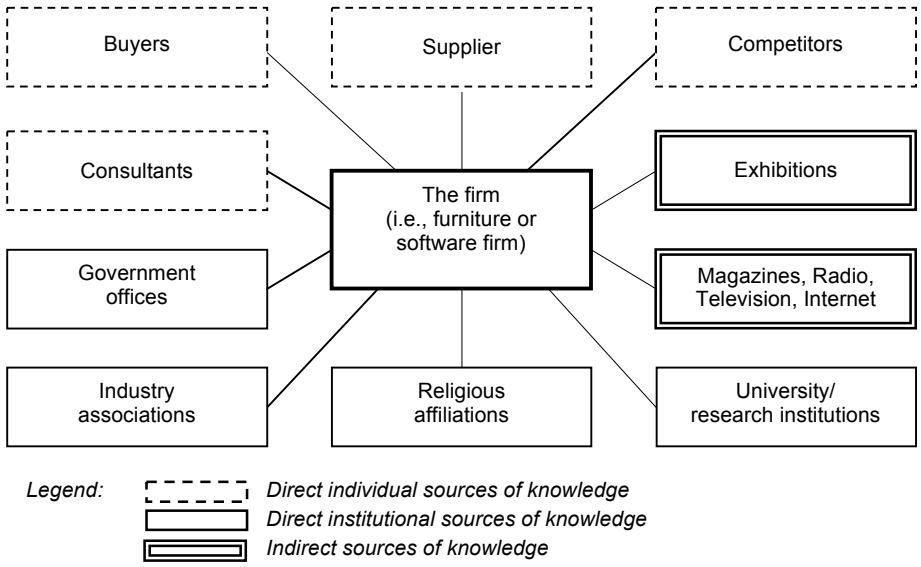

Figure 4.1. Value chain network or value creating system
(inspired by Porter, 1985; 1990)

4.3 The Importance of Interaction for Innovation as an Indicator of Absorptive Capacity

The resource-dependency theory (i.e., Pfeffer and Salancik, 1978; Ulrich and Barney, 1984) as discussed in Chapter 2 indicates firm's need for interaction. The need for resources (i.e., knowledge) from the external environment appears to be a firm's main reason to interact with other parties. The innovation literature addresses the interest of firms to tap into external sources of knowledge through interaction with the external environment by using the open innovation concept (Chesbrough, 2003; Chesbrough et al., 2006), a paradigm derived from an earlier one, named closed innovation[18] (Chesbrough, 2003). This new paradigm is based on a different knowledge landscape with a

[18] According to this view successful innovation requires control. Firms must generate their own ideas and independently develop, build, market, distribute, service, finance, and support them by means of R&D (Chesbrough, 2004:23).

different logic about sources and the use of ideas. The open innovation paradigm assumes that in order to generate additional value, firms can and should make use of internal as well as external ideas through external channels outside their regular business environment (Chesbrough, 2004).

The notion of interaction with the external environment has been discussed by Nooteboom (1992) by means of the term 'external economy of cognitive scope'. Nooteboom (1992) views a firm as a 'focusing device' arguing that interaction is "a means of bringing people together on a shared purpose, with a shared view, matched competences and coordination of action to achieve it" (Nooteboom 1992; 1999:12). In order to achieve a specific joint goal on a level which is higher than commonly required for meeting basic needs, the people involved (the organization) must be aligned and lifted to some extent (Nooteboom, 1992). Furthermore, Nooteboom (1999:13) indicates: "If knowledge depends on categories of thought which develop in interaction with the physical and social environment, then thought is path dependent and idiosyncratic. People will be able to understand each other only to the extent that they have developed their categories in a shared environment and in mutual interaction.". This view implies that interaction facilitates the transfer or the absorption of knowledge and stimulates the development of novelty (Nooteboom 1992), particularly in the context of the development of new products, the production process, markets, or forms of organizations (Nooteboom, 2004).

From another point of view, Tether (2002) argues that the basic reason for a firm to interact is to combine complementary skills (e.g., know-how) without having to make the large investments that are required when a product has to be developed internally. Similarly, Meeus et al. (2004) argue that firms interact with external parties with the aim of extending their internal knowledge bases for the benefit of innovation. The advantages of interaction may be twofold: first, by establishing information channels, knowledge flows can be embedded in the organization, and second, these knowledge flows can serve as input in the creation of new knowledge, which can be disseminated through the organization and used in the realization of new products, services, and systems (Nonaka and Takeuchi, 1995). In line with Meeus et al. (2004), Yli-Renko et al. (2001) suggest that repeated interaction with other firms enhances the possibilities for evaluation as well as for obtaining knowledge from other firms on a pertinent basis.

From the perspective of social networks, Kristiansen and Ryen (2002), and Mackinnon et al. (2004) show social connections with extra-local networks play a crucial role in obtaining access to wider sources of information and knowledge. Burt (1992) describes as the main benefits of network relationships the access to

either information or knowledge and to useful referrals. These two benefits "improve the ability of a firm to acquire relevant knowledge from outside" (cited in Nahapiet and Ghoshal, 1998). Similarly, Tsai and Ghoshal (1998:465) argue that interaction in terms of network ties influences a firm's capability of acquiring knowledge. Interaction enables firms to gain access to external knowledge more easily and to increase their knowledge input, which can ultimately be used to enhance their innovative output.

In a European context, Rothwell (1991) observes that small firms engaged in more extensive relationships with external parties are more successful in innovation. Similarly, a recent study among small Canadian software firms by Spraggon and Bodolica (2008) shows that interaction via formal meetings and informal networks increase a firm's body of knowledge and stimulate its activities in the field of innovation. In other words, the frequency and density of interaction determines the extent to which knowledge is generated, utilized, and distributed (Caloghirou et al., 2004).

Aside from the advantages of interaction with external sources of knowledge, particularly regarding the promotion of a firm's innovativeness, there is also a risk. This risk concerns the possibility that ideas are being stolen (Hellman and Perotti, 2006). For instance, during a face-to-face meeting of a furniture firm with some of its buyers, sensitive information regarding the production of new tables/beds for the European markets may be exchanged. Although this free circulation of ideas may increase the firm's insights into the market's tastes, there is also a fundamental problem, namely the danger that knowledge (i.e., idea) is being stolen (Hellman and Perotti, 2006). From a social perspective, the free circulation of ideas in an open exchange environment facilitates a complete screening and elaboration of all ideas[19]. Given the novelty and incompleteness of these ideas, they might be conveyed to other firms. In this case, an external knowledge spillover occurs, from which parties outside the firm may benefit.

As already discussed (see Chapter 2), many SMEs, especially in developing countries including Indonesia, are faced with classical problems, such as a lack of access to the market, knowledge, and financial and institutional support (Mead and Liedholm, 1998; Indarti and Langenberg, 2004). These boundaries hinder a firm in exploring opportunities, thereby undermining its innovativeness. This problem may be tackled by various initiatives, carried out both internally within the firm or externally, such as the formulation of governmental policies meant to support these firms.

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[19] Ideas are private information; they are too incomplete to be patentable (Hellman and Perotti, 2006).

From an internal point of view, intensive interaction with diverse external parties has a stimulating effect on a firm's activities in the field of innovation. It has therefore become a crucial objective in developing regions to provide SMEs with useful resources and opportunities with respect to obtaining knowledge. The aim of this study is to make a theoretical contribution to the debate about the role of the interaction of SME-businesses in a developing country as well as to provide policy makers with a framework for dealing with this issue. The next section discusses various types of interaction with relevant external parties.

4.4 Parties Involved in Interaction

Firms can improve their products and performance by interacting with external parties, both directly and indirectly. Previous studies (e.g., Smeltzer et al., 1988; Fann and Smeltzer, 1989; Tidd and Trewhella, 1997; Van Geenhuizen and Indarti, 2008) have shown that the variety of parties which can be involved in interactive relations with a firm is large: buyers, suppliers, competitors, government offices, industry associations, religious affiliations (see Van Geenhuizen and Indarti, 2008), universities, consultants, and also media-exposure. All of them are considered as sources of knowledge which have an impact on a firm's innovativeness. In the context of Indonesia, Van Geenhuizen and Indarti (2005) claim that the degree of interaction between SMEs and these external parties is not sufficiently developed, while the possible advantages of these relations have not yet been properly explored. These advantages concern a broader access to relevant know-how, possibilities to perform benchmarking activities, as well as opening new markets. One of the main focal points of the current study is to examine the impact of interaction on a firm's ability to absorb and utilize knowledge from the external environment. In this section the discussion will primarily concentrate on the effect of interaction on the firm's ability to absorb knowledge from external parties (i.e., absorptive capacity) and the utilization of this knowledge (i.e., innovation). We have categorized interaction into two forms: direct and indirect interaction. The following subsections will deal with these forms in more detail.

4.4.1 Direct interaction

One speaks of direct interaction when a firm interacts directly with other parties. Direct interaction can be classified into two types, based on the types of parties of which there are two: direct individual and direct institutional ones. Direct individual parties are buyers, suppliers, competitors, and consultants. These agents personally interact with the firm. Direct institutional interaction takes place between firms and institutions.

4.4.1.1 Direct individual interaction

Next, the nature of this type of interaction and its possible benefits for the firm are described.

1. Buyers

It is commonly accepted that the relationship between a firm and its buyers is essential for the firm's business success. Lundvall (1985) distinguishes three different forms of relationships between firms and customers: the exchange of products, the exchange of information or knowledge, and cooperation. The interaction between a customer and a producer entails the regular flow of tangible or intangible products from the producer to the customer. During this interaction, information on various issues is transferred from the producer to the customer and vice versa. The cooperation might take place in different stages, starting when the new product is initiated, and continuing throughout the product's production and adoption stages. These three forms of cooperation (i.e., initiation, production, adoption) may either take place as mutually exclusive interactions or as one simultaneous cooperation trajectory.

In a study conducted in Lesotho, Masten and Brown (1993: 142) argue that good customer relationships are crucial for the successful development of small-scale firms, especially in the garments, leather, and metal works branches. In a survey conducted among 100 entrepreneurs, the interviewees felt that "the most important skill contributing to success is treating customers well and listening to what customers were saying. The second most important skill is the ability to develop a reputation for providing high-quality goods and services". In Ghana, Barr (2000) also finds that regular and close contacts between buying and selling enterprises facilitate flows of knowledge between them. In addition, in a study conducted in Indonesia, Sandee (1994) has documented in detail how close contacts between traders and middlemen resulted in the transfer of essential technical, financial, and market information. With the aid of middlemen and networks, rural industries are given the opportunity to develop, even without the support of local markets.

Interaction with buyers also provides better insights into the needs of influential customers, which helps firms in analyzing problems and finding solutions (Von Hippel et al., 1999). In addition, it enables them to anticipate market trends. All these advantages increase the chances of success (Tsai, 2009), which implies that to become a market leader, knowledge and learning is required. In addition, several authors (Freel, 2003; Faems et al., 2005) find that collaboration or interaction with customers has a positive impact on product innovation performance. Also Monjon and Waelbroeck (2003), who studied French

manufacturing firms using firm-level data, indicate that customer collaboration or interaction has a significant impact on firms' product innovations.

This study investigates the impact of the interactive relationships between firms and their buyers on these organizations' innovativeness in the context of a developing country (i.e., furniture and software firms in Indonesia). We expect that the higher the level of interaction between a firm and its buyers, the better the firm will perform in terms of innovativeness.

2. Suppliers

Many authors (e.g., Eisenhardt and Tabrizi, 1995; Nieto and Santamaria, 2007; Van Geenhuizen and Indarti, 2008) argue that interaction between a firm and its suppliers significantly stimulates the accumulation of knowledge which can be used in the innovation of the firm's products. Through their relationships with the suppliers of materials and machinery, for instance, firms are allowed to become more knowledgeable in certain areas, whereby they can improve their solutions to problems and/or create new methods of innovation, also called product development (Eisenhardt and Tabrizi, 1995). Suppliers generally have a greater expertise with respect to the specific parts and components which are critical in the development of new products (Tsai, 2009). Furthermore, Kessler and Chakrabatri (1996) argue that interaction with suppliers helps firms identify potential technical problems more quickly, enabling them to realize their innovations in a shorter period of time (i.e., the development of new products and responses to market demands).

Nieto and Santamaria (2007), who studied manufacturing firms in Spain, state that interaction or collaboration with suppliers has a positive effect on product innovation. Scholars who investigated manufacturing firms in France, however, argue that interaction with suppliers does neither improve the product performance nor the innovation activities of these companies (Perez and Sanchez, 2003). This outcome is similar to the findings of a study in the UK on small and medium-sized manufacturing firms (Freel, 2003). Given these mixed results, we will also particularly focus on the impact of interaction with suppliers on the innovativeness of firms.

3. Competitors

Apart from interacting with its customers and suppliers, a firm also collaborates with other similar firms, which can be labeled as competitors. This interaction may take place both directly and indirectly. Indirect interaction means, for example, that a firm looks at the products of its competitors. According to Iacobucci (1996:29), horizontal interaction with competitors among small entrepreneurial firms "is not cut-throat or zero-sum, but rather there is a friendly,

even co-operative atmosphere where personnel and information flow back and forth freely among competitors".

Many authors suggest that horizontal interaction or collaboration with competitors is positively related to a firm's innovativeness (Linn, 1994; Inkpen and Pien, 2006). Linn (1994) argues that cooperation with competitors enables firms to gain an insight into their technological know-how. Firms that are more knowledgeable about the technology strategies pursued by their competitors are better capable of differentiating themselves. In their case study conducted in China at the Singapore Suzhou Industrial Park (SIP), Inkpen and Pien (2006) suggest that firms which collaborate with competitors perform better in the field of innovation than they would otherwise. One of the most often-cited motives for competitor collaboration is to obtain cost advantages by jointly exploiting economies of scale (Barney, 2002). It is quite common for competitors to share part of their value-creating activities, such as technology development, product design, manufacturing, marketing, distribution, and services (Ghosh and Morita, 2007). In the current study we have also included the relationships between SMEs in Indonesia and their competitors.

4. Consultants

Consultants are considered to play crucial roles in the advancement of firms' innovation policies (see Kelly, 1999; Tether and Tajar, 2008). Kelly (1999) mentions as the main reason for firms to hire design consultants is the opportunity to gain new insights (i.e., knowledge), thereby stimulating the climate for innovation. In their study conducted among manufacturing and services firms in the UK, Tether and Tajar (2008) observed that the firms interacted with specialist knowledge providers (i.e., consultants) as informal sources of innovation. Further, also relationships with other specialist knowledge providers, such as private research organizations as well as other external sources of knowledge, tend to play a complementary role in firms' internal innovation activities. Tether and Tajar (2008) conclude that there are significant differences in the types of specialist knowledge providers approached by manufacturing and service firms. In the context of Indonesian SMEs, the interaction of firms with their consultants or other private specialist knowledge providers, especially aimed at stimulating the innovation policies of these organizations, has as yet not been properly documented.

The intensity of the interaction with direct individual parties, i.e., buyers, suppliers, competitors, and consultants, is expected to have a significant impact on a firm's absorptive capacity as indicated by its innovativeness. Face to face interaction with these parties may offer a range of possibilities to capture knowledge in various forms. It will enable firms to benchmark themselves with

their competitors and to scan market trends, not to mention other benefits which can help them in the process of taking appropriate business decisions.

4.4.1.2 Direct institutional interaction

The following sections give an overview of the different actors playing a role in the direct institutional form of interaction. In addition, an explanation is given of the possible benefits for firms to engage in this form of interaction with external institutions.

1. Government institutions

The government plays an important role in the support and stimulation of firms' activities in the field of innovation by providing facilities and implementing supportive policies. Facilities provided by the government include various means for skill development, the open access to government research organizations, and a patent office (Segelod and Jordan, 2002; Hughes, 2001). A study conducted in the UK (Hughes, 2001) indicates that 50% of the innovative firms here have benefited from the knowledge provided by government research organizations, while only 20% of the innovative firms in the US have done so.

In the Indonesian context, the government – especially the Ministry of Trade and the Ministry of Cooperatives and Small- and Medium-Sized Enterprises – regularly provides various kinds of support, for example training, the dissemination of new technology to gain access to external knowledge easier through various channels, such as exhibitions, and relevant skill development programs. To some extent, government offices also provide information on domestic as well as export opportunities. However, no specific research has as yet been conducted into the relationship between SMEs and government institutions in relation to knowledge acquisition and innovation.

2. Industry associations

According to Hauschildt (1992) industry associations, which promote the interaction and exchange of knowledge between firms, are considered as mediating parties. An industry association generally serves as a knowledge pool containing information on various domains, from knowledge about new technology to information regarding market opportunities. In the context of Indonesia, industry associations frequently act as partners of the government in the formulation of policies which can affect certain industry sectors, such as the software and furniture branches. In the case of these two sectors, industry associations are not only found on the national, but also on the district level, where the local firms interact more intensively.

Despite the potential roles of the industry associations, the benefits of interaction in terms of possibilities for innovation as perceived by the firms are

still debatable. This is because in some cases the functioning of these associations is not optimal. With respect to Indonesia, there are national industry associations in both the furniture and the software branches, namely the Association of Indonesian Furniture and Handicraft Industry (*Asosiasi Industri Permebelan dan Kerajinan Indonesia, Asmindo*) and the Association of Indonesian Software Developers (*Asosiasi Piranti Lunak Indonesia, Aspiluki*), respectively.

When an industry association plays its role well without causing any conflicts of interest among its participants, and the latter are given sufficient opportunities to obtain relevant knowledge, they will be willing to maintain a good relationship with this institution. In turn, a good relationship with an institution of this kind is beneficial for the firms in terms of their knowledge absorption and business development.

3. *Religious affiliations*

Previous studies have documented how social networks play crucial roles in providing access to wider sources of knowledge (Kristiansen and Ryen 2002; Mackinnon et al., 2004). Both formal and informal social networks function as a means for firms to reduce, for example, transaction costs or risk and improve the access to business ideas and knowledge. A social network consists of a series of either formal or informal ties between the central actors and other actors in a circle of acquaintances. The quality of a social network is determined by the number of social relations, the diversity of the ties, and the network dynamics (Johannisson, 1995).

Using this perspective, we argue that in the Indonesian context, where the collectivistic aspect of culture is highly dominant (Hofstede, 1991), informal ties, such as religious affiliations, form an important source of knowledge. In this country, religious activities do not only take place in mosques and churches, but are also embedded in the societal context (Candland, 2000). Van Geenhuizen and Indarti (2008) have found that the more innovative small furniture manufacturers in Jepara, Indonesia, make a relatively extensive use of knowledge sources in the form of friends, neighbors, and religious affiliations. However, the notion that a firms' innovativeness is significantly affected by its interaction with religious groups in obtaining external knowledge is still questionable. Therefore, in our study we also concentrate on the relationship between a firm's interaction with religious groups and its innovativeness.

4. *Research institutions/universities*

According to Hauschildt (1992), research institutions and universities are considered as scientific systems which function as sources of external knowledge. In a study carried out by Segelod and Jordan (2002) among 92 software firms in

Europe, the authors conclude that linkages with scientific systems and public authorities are less important than associations with mediating parties (e.g., consultants) and markets (e.g., customers and suppliers). They do indicate however, that firm size may matter in this regard. The scientific system appears to be less relevant to SMEs, while Tidd and Trewhella (1997) have found that for large firms, universities are the most important sources of external technology.

Interaction with other institutions or groups of people, such as government institutions, industry associations, religious affiliations, and research institutions/universities are believed to have an impact on a firm's innovativeness. The more intensive the interaction with these parties, the higher the degree of a firm's innovativeness.

4.4.2 Indirect interaction

As opposed to direct interaction, in which a party and the knowledge provider are both physically present, such as face-to-face or personal contact, indirect interaction offers firms the possibility to interact with the help of technology without the actual presence of the knowledge provider. In the context of the current study, exhibition, mass and electronic media, and the Internet are considered as instruments of indirect interaction. Several authors have pointed out the importance of indirect interaction as a firm's access to knowledge to be used for the stimulation of its innovativeness (Kristiansen et al., 2005; Baron, 2003). Another focal point of this study is therefore to examine the relationship between a firm's interaction through exhibitions, mass and electronic media, and the Internet and its absorptive capacities (a firm's innovativeness).

1. Exhibitions

Exhibitions are considered as an important venue for firms to interact with other parties. At an exhibition, there are more opportunities to meet suppliers and buyers and to make deals, while at the same time firms can set new benchmarks by comparing their performance with that of their competitors. Hauschildt (1992) considers the exhibition as a significant mediating system in addition to consultants and mass media.

In Indonesia furniture exhibitions are organized on a regular basis, both on a provincial and on a national level. Every year the members of the Association of the Indonesian Furniture and Handicraft Industry actively participate in regional as well as national furniture events. Their participation is mainly directed at the promotion of their products and attracting prospective buyers. In the software sector in Indonesia, there are exhibitions specifically meant for the computer software industry. Generally, the software developers attend these

regular computer exhibitions organized in the big cities, such as Jakarta, Medan, Bandung, Yogyakarta, and Surabaya.

2. Mass and electronic media (magazines/newspapers, radio, and television)

It is generally recognized that exposure to media, such as magazines/newspapers, radio, and television, creates opportunities for gaining access to business information and obtaining new knowledge. In their studies of entrepreneurship in India, Singh and Krishna (1994) point out that eagerness with respect to information-seeking is one of the most important entrepreneurial characteristics. Information-seeking refers to the frequency with which an individual consults various sources of information, such as newspapers, magazines, and books. In their study of cottage industries in Tanzania, Kristiansen et al. (2005) show that media exposure has a significant positive effect on innovation.

3. Internet

Baron (2003) claims that a frequent usage of the media, including the Internet, increases the possibilities for firms in the field of innovation. The Internet is a more modern source of knowledge and at the same time an efficient medium of knowledge transfers. Firms may use the Internet to search for scientific and technical knowledge or to exchange information with buyers and suppliers or other parties through communication channels such as e-mail and online discussion forums (Caloghirou et al., 2004).

Recent studies have identified various benefits offered by the Internet, such as possibilities in the sphere of obtaining know-how through discussion channels, possibilities for benchmarking the competitor's performance, as well as time- and money-saving ways of gaining quick access to relevant knowledge (Walcszuch et al., 2000; Hisrich and Peters, 1998). Results of previous studies (Martin, 2004; Caloghirou et al., 2004) have shown that the impact of the Internet on innovation has been mixed. In a study conducted among small hospitality firms in the UK, Martin (2004) shows that the adoption of information communication technology (the Web) has changed the business processes in these organizations. In contrast, the results of a study by Caloghirou et al. (2004) on chemical, food, and computer firms show that the Internet has not had a significant impact on the innovativeness of these companies.

The media have created a world without borders and have played an important role in improving the access to information without a direct physical interaction between the information seekers and the information producers. The rise of the Internet has facilitated the quick retrieval of information, enabling firms to obtain relevant knowledge in an efficient manner.

Table 4.1. Parties involved and the effects on a firm's innovation

No.	Involved parties	Observed effect	Source
	Direct individual		
1.	Buyers	+	Barr (2000); Sandee (1994); Freel (2003); Faems et al. (2005); Monjon and Waelbroeck (2003)
2.	Suppliers	+/-	Eisenhardt and Tabrizi (1995); Nieto and Santamaria (2007);
3.	Competitors	+/-	Linn (1994); Inkpen and Pien (2006); Nieto and Santamaria (2007); Pérez and Sánchez (2003); Freel (2003).
4.	Consultants	+	Kelly (1999); Tether and Tajar (2008)
	Direct institutional		
5.	Government offices	+	Hughes (2001)
6.	Industry associations	+	Hauschildt (1992)
7.	Religion affiliations	+	Kristiansen and Ryen (2003); Mackinnon et al., (2004); Van Geenhuizen and Indarti (2008)
8.	Research institutions/universities	+	Hauschildt (1992); Segelod and Jordan (2002); Tidd and Trewhella (1997)
	Indirect interaction		
9.	Exhibition	+	Hauschildt (1992)
10.	Mass and electronic media (magazines/newspapers, radio, and television)	+	Kristiansen et al., (2005)
11.	Internet	+/-	Baron (2003); Walcszuch et al., (2000), Hisrich and Peters (1998); Caloghirou et al., (2004)

4.5 Conclusion

In Table 4.1 we list all parties involved in interaction and summarize the expected effects on the innovativeness and absorptive capacity of firms. As can be seen, to the majority of the external parties applies that their interaction with firms has clearly a positive impact on these organization's innovativeness as the indicator of their absorptive capacity. However, in the case of suppliers, competitors, and the Internet the results have appeared to be mixed.

Interaction is considered as a condition for enabling firms to address external resources (i.e., knowledge) and use it to produce commercial output. The reasons for and the nature of the interaction of firms can be conceptualized by means of the resource-dependency theory and the value chain approach. In the context of this study, interaction is defined as the intensity of the relationships or contacts between a firm and other parties, either directly or indirectly. Buyers, suppliers, competitors, and consultants are categorized as direct individual actors, while government offices, industry associations, religious affiliations, and

research institutions/universities are considered as direct institutional parties. In addition, exhibitions, mass and electronic media, and Internet are classified as indirect forms of interaction. These different types of interaction are considered as sources of knowledge which have significant effects on the innovativeness of firms. A detailed discussion of the research questions and hypotheses will be presented in Chapter 5.

The discussion of interaction in this chapter mainly concentrated on the definitions, the parties involved, and the impacts on firms' absorptive capacity (i.e., innovation). The issue of the media as instruments of interaction (face-to-face, telephone, facsimile) was already discussed in Chapter 3 (Section 3.6.2.2). Here we have dealt with the characteristics of the media as channels of interaction which may have an influence on the capability of firms to absorb and utilize external knowledge (i.e., stickiness).

5. Questions, Conceptual Model, and Hypotheses

5.1 Introduction

The previous chapters have presented literature reviews of the organizational concepts absorptive capacity and interaction, and the characteristics of knowledge. In this chapter we will introduce the main research questions, the conceptual model, and the research hypotheses.

5.2 Research Questions

As discussed in Chapter 3, many scholars have pointed out that knowledge plays an important role for organizations in maintaining their growth and survival. The knowledge-based theory views a firm as a knowledge-creating entity and considers knowledge as the most strategically significant resource of a firm. Further, the resource-based theory regards knowledge as a strategic resource when it is valuable, rare, inimitable, and embedded within the organization (Barney, 1991).

However, quite often a firm cannot solely rely on the knowledge embedded within the organization, but needs to reach beyond its own boundaries to gain access to external knowledge, which is often not easy to absorb (i.e., sticky). As already mentioned in Chapter 3, in this study a piece of knowledge is considered as sticky when its accessibility is low. Accessibility refers to the degree to which a piece of knowledge is easy or hard to understand or reach. Hence, based on the aforementioned theories and the findings of previous research (see Chapter 2 and Chapter 3), the following main research question has been formulated:

What is the effect of the stickiness of external knowledge on a firm's absorptive capacity?

We recognize that stickiness is a complex concept. The intention of this study is to measure the stickiness of knowledge (see Chapter 3) on the basis of specific characteristics, namely content or domain and type of knowledge. Content of

knowledge is operationalized as interconnectedness of knowledge. Thus, the more domains the knowledge deals with, the more interconnected it is. Type of knowledge is measured by determining whether it is sensory, coded, and theoretical. These characteristics determine the degree of accessibility of the knowledge from the perspective of the knowledge seeker. Stickiness that is related to other aspects which can make it difficult to gain access to knowledge, such as physical distance, is outside of the scope of this study. Chapter 3 has discussed the knowledge characteristics. The relationship between each knowledge characteristic and a firm's absorptive capacity will be further elaborated in Section 5.4.

In order to absorb external knowledge, a firm has to interact with external parties as the sources of this knowledge. Some scholars (Nonaka, 1994; Nonaka and Takeuchi, 1995; Tsai and Goshal, 1998) argue that interaction plays an important role in a firm's innovativeness (as an indicator of absorptive capacity). The aforementioned theories and the findings from prior studies (see Chapter 2 and Chapter 4) indicate that the intensity of the interaction between a firm and external parties has an impact on the firm's absorptive capacity. Based on this conclusion, the second main research question is presented:

What is the influence of interaction on a firm's absorptive capacity?

5.3 Conceptual Model

We have developed a conceptual model that shows the interrelationships between variables (see Figure 5.1). As depicted, the stickiness of external knowledge is predicted to have a negative impact on a firm's absorptive capacity (1). The higher the level of stickiness of the external knowledge, the lower a firm's absorptive capacity. We also expect that the intensity of a firm's interaction with external sources of knowledge has a positive influence on its absorptive capacity (2). Thus, the higher the intensity of a firm's interactive behavior, the higher its absorptive capacity.

Also size and age are expected to have an impact on the relationships of a firm's absorptive capacity (Chapter 2) with a) the stickiness of external knowledge (Chapter 3) and with b) interaction (Chapter 4). According to Salavou et al., (2004), firm size is one of the most powerful predictors of organizational innovation. In addition, some scholars argue that larger firms are more innovative than smaller ones (Damanpour, 1996; Dewar and Dutton, 1986; Kimberly and Evanisko, 1981). However, although there are studies that contradict this view (Rothwell, 1978; Liao et al., 2003), their counter arguments are not as clear as the findings which support the positive impact of a firm's size on its innovativeness.

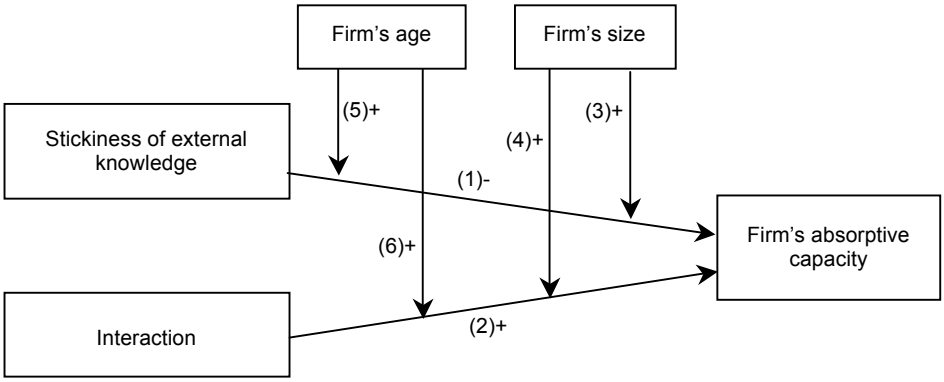

Figure 5.1. Conceptual model (simplified)

As indicated in Chapter 3, knowledge is embedded in the human mind. Organizational knowledge can be considered as the total sum of knowledge possessed by all individuals in an organization. Following this line of reasoning, firms with a larger number of employees have a larger internal knowledge capacity. As a result, these firms tend to perceive external knowledge as less sticky. Similarly, in the context of interaction (Chapter 4), larger firms have a more intense interaction with external sources of knowledge compared to smaller firms. Hence, the relationships of an organization's absorptive capacity with the stickiness of external knowledge (3) and with interaction (4) are expected to be stronger in the case of larger firms.

Some scholars claim that older firms are more likely to introduce new products than younger firms (Avermaete et al., 2003; Sørensen and Stuart, 2000). Previous empirical findings support the view that during a firm's lifespan the organizational operations and competencies that trigger innovations improve gradually (Sørensen and Stuart, 2000). However, another study found that a firm's age has a negative impact on its absorptive capacity, i.e., innovative power (Lee and Sung, 2005). So although the results with respect to the impact of a firm's age are mixed, a positive relationship between a firm's age and innovation appears to be prevalent.

In a similar vein (Chapter 3 and Chapter 4), older firms with more experience differ in their perception of the stickiness of external knowledge from younger firms. Likewise, the interaction of older firms with external sources is more intense than that of younger firms. Consequently, the relationships of an

organization's absorptive capacity with the stickiness of external knowledge (5) and with interaction (6) are expected to be stronger in the case of older firms.

We are aware that in some cases there may be a correlation between a firm's size and its age. A larger firm in terms of number of employees may be a result of the fact that the organization has existed for a longer period of time.

5.4 Hypotheses

Taking the aforementioned theories and the conceptual model as our point of departure, several hypotheses can be formulated. In this study, the focus is on examining the impact of the stickiness of external knowledge on a firm's absorptive capacity. In the context of this study, stickiness is explained by the degree of accessibility (see Chapter 3) of knowledge domains (knowledge interconnectedness) and by distinguishing between three types of knowledge (sensory, coded, and theoretical knowledge).

The interconnectedness of knowledge refers to the degree to which knowledge covers various domains (Simon 1976; Jorna, 2006; Van der Spek and Spijkervet, 1997). When a piece of absorbed knowledge consists of several interconnected domains, it provides a fuller picture of specific information, which in turn makes the knowledge as a whole easier to absorb and understand. In other words, the more interconnected domains of knowledge are available, the higher the degree of accessibility. The higher the degree of accessibility, the lower the stickiness, and consequently, the higher a firm's absorptive capacity.

When knowledge is characterized as personal, it is dependent on its context. This kind of knowledge is very difficult to express; it may even only be possible to express it by means of behavior. Polanyi (1962) calls this tacit knowledge. Such knowledge is hard and sometimes impossible to communicate through words (symbols in general). It can only be obtained through imitating and copying the behavior (of others). We suggest labeling tacit knowledge as sensory knowledge when it is impossible to express (Jorna, 2006). Depending on the degree of detail acknowledged by a recipient, sensory knowledge can be either rough or detailed. From the perspective of the recipient, rough sensory knowledge is less accessible, and hence stickier. On the other hand, detailed sensory knowledge is more accessible, which makes it less sticky.

Knowledge can also be available in the form of various kinds of codes. Coded knowledge includes the use of signs and symbols which refer to objects or experiences (Jorna, 2006). By using coded knowledge it is possible to communicate and exchange information without the actual presence of the object to which this knowledge refers or even without the presence of the communicating actor him/herself (Jorna, 2006). Various kinds of code exist,

depending on the degree of ambiguity of the sign and symbol systems (Cijsouw and Jorna, 2003): the weaker the code, the more ambiguity. Strongly-coded knowledge (such as in formulae or scores) is easier to understand since it is not ambiguous. However, although it makes the knowledge more accessible and hence less sticky, learning the code takes a lot of time. On the other hand, weakly-coded knowledge (icons or pictures) is stickier because it is more ambiguous in that it requires much more interpretation.

Theoretical knowledge refers to grasping the structure or pattern of a concept (object, or event) (Cijsouw and Jorna, 2003). Understanding a concept implies that it can be explained and reasoned about; one can correctly use its terminology and indicate the relations of the concept with other concepts (Cijsouw and Jorna, 2003). Theoretical knowledge can vary from abstract to concrete (i.e., degree of abstractness). The degree of abstractness of theoretical knowledge is related to the complexity and length of the causal chains (the why-chains). The more complicated the why-connection, the more abstract the knowledge. A piece of knowledge that consists of many causal relations is more abstract. Such knowledge becomes hard to understand and is therefore stickier.

Based on the four characteristics (i.e., interconnected, sensory, coded, and theoretical) as the indicators of stickiness, the following hypothesis has been formulated.

H1: The lower the stickiness of external knowledge, the higher a firm's absorptive capacity.

As already explained in Chapter 4, in order to absorb external knowledge a firm has to interact with external parties as the sources of this knowledge. Many scholars have pointed to the existence of the phenomenon of interaction and its relevance for firms in the improvement of their absorptive capacity. Nonaka (1994) argues that interaction plays a critical role in the articulation and amplification of knowledge. Other scholars (Ghoshal and Bartlett, 1988; Levinson and Asahi, 1995, Steensma, 1996; Lane and Lubatkin, 1998) state that interaction between a firm and other organizations enhances and stimulates the firm's ability to acquire and absorb new knowledge and to utilize it in the creation of innovative products (i.e., absorptive capacity). In other words, the intensity of the interaction between a firm and external parties has an impact on its absorptive capacity. These arguments have led to the following hypothesis.

H2: The higher the intensity of interaction, the higher a firm's absorptive capacity.

Impact of a firm's age and size

In this study we also examined the influence of a firm's age and size as moderating variables of the relationships of a firm's absorptive capacity with the stickiness of external knowledge and with interaction. As discussed in the previous sections, older and larger firms have more experiences, more sophisticated technology/equipment and a longer learning history as compared to younger and smaller firms.

As a firm develops, its business networks expand and it will provide the firm more various prospective knowledge sources. As knowledge can also be obtained from the external environment through relational networks which span organizational boundaries, these networks are efficient mechanisms for accessing and integrating new knowledge (Grant, 1996; Kogut and Zander, 1996). When stickiness of knowledge in the business network decreases, the external knowledge will be more accessible and the amount of possible knowledge absorbed by older and larger firms will be much greater than by younger and smaller firms due to differences in their business network size. As a result, the firms' absorptive capacity will increase. Hence, we may conclude that the effect of a firm's age and size on the relationship between stickiness of knowledge and absorptive capacity is stronger for older and larger firms than for younger and smaller firms. Therefore, the following hypotheses have been formulated.

H3a: The relationship between the stickiness of external knowledge and absorptive capacity is stronger for older firms than for younger firms.

H3b: The relationship between the stickiness of external knowledge and absorptive capacity is stronger for larger firms than for smaller firms.

Using a similar argumentation, as a firm grows its interaction with external parties is also strengthened, as indicated by the intensity of its interaction. What is perceived by younger and smaller firm as an intensive relationship may be experienced as less intensive by older and larger firms. In addition, maintaining relationships with external parties at a continuous level is more difficult for younger and smaller firms. Hence, we present the following hypotheses.

H4a: The relationship between interaction and absorptive capacity is stronger for older firms than for younger firms.

H4b: The relationship between interaction and absorptive capacity is stronger for larger firms than for smaller firms.

Again, also the knowledge-intensiveness of a firm may have an impact on its absorptive capacity. Firms which are more knowledge-intensive, for example software firms, are believed to have a higher absorptive capacity compared to

less knowledge-intensive firms (i.e., furniture firms). As is explained in Chapter 3, Alvesson (2004) defines knowledge-intensive firms as organizations where most work is claimed to be of an intellectual nature and where well-educated employees form the major part of the workforce. Most knowledge-intensive organizations, such as accounting firms, software companies, advertising agencies, research and development units, and high-tech businesses offer qualified services (Alvesson, 2004). Alvesson's definition does not mean, however, that the companies operating in the manufacturing sector, such as furniture firms, do not require a substantial level of knowledge to grow and to innovate.

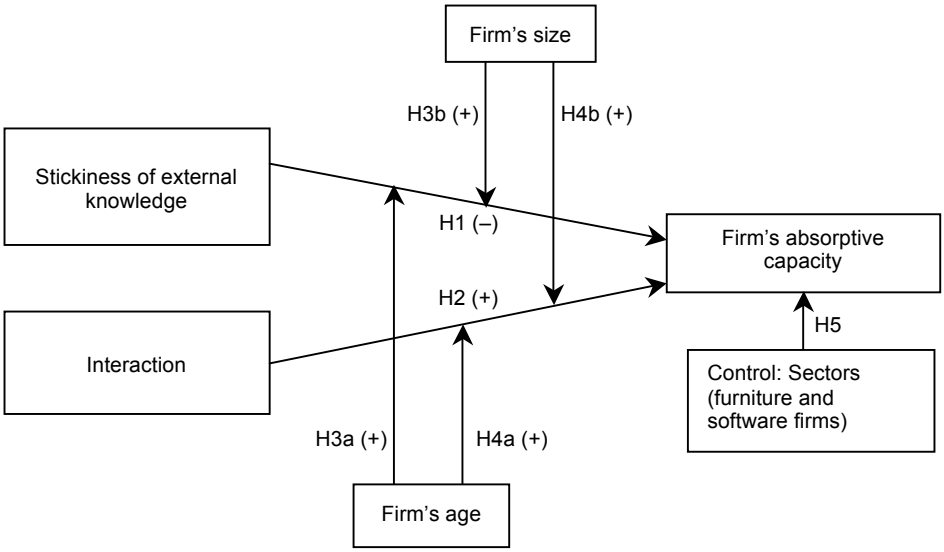

Figure 5.2. Empirical research model (complex)

In order to avoid a possible misunderstanding in this study, the latter type of firms (exemplified by furniture firms) will be termed "less knowledge-intensive firms", while the former type (exemplified by software firms) will be labeled "more knowledge-intensive firms". This categorization is based on the level of education of the employees in the various sectors (see Alvesson, 2004; Starbuck, 1992). In software firms, most of the work is intellectually oriented (software requirement analysis, design, coding, testing, and implementation) and most employees are well-educated. A different picture is presented by furniture firms, where the level of education of most employees is usually lower than of those who are working in technology and computer businesses. Mastering the manufacturing process in a furniture firm does not necessarily require a high

educational background. What is mainly important here is a lot of practice. Based on this argument, the following hypothesis has been formulated.

H5: The absorptive capacity of software firms (as more knowledge-intensive firms) is higher than the absorptive capacity of furniture firms (as less knowledge-intensive firms).

Note that for testing the hypotheses, absorptive capacity is measured using both the potential and realized absorptive capacity (see Chapter 6). Figure 5.2 summarizes all hypotheses explained above.

5.5 Conclusion

This chapter primarily discussed the research questions and the relationships between the independent variables (i.e., stickiness of external knowledge and interaction) and the dependent variable (i.e., a firm's absorptive capacity). In addition, we explained the effect of the firm's size and age as moderating variables in both relationships. Finally, in this chapter we presented and clarified the research hypotheses and the empirical research model.

6. Research Methodology

6.1 Introduction

This chapter describes how we conducted our extensive fieldwork in a number of small- and medium-sized enterprises in the software and furniture sectors in Indonesia. As previously discussed in Chapter 3 and Chapter 5, the furniture firms represent the less knowledge-intensive firms and the software firms the more knowledge-intensive firms.

As the main objective of this study is to explore and to understand the phenomena of knowledge absorption in SMEs and how the firms interact with their environment, we used a clear definition of Indonesian SMEs formulated by the Indonesian Statistics Bureau (www.bps.go.id). The Bureau classifies small- and medium-sized enterprises in terms of their number of employees: small firms employ less than 20, and medium-sized firms less than 100. In the Indonesian context, SMEs are firms engaged in activities on a small to medium scale, and they have the following characteristics: (1) they are owned by Indonesians; (2) they are individual companies, usually home or family businesses, either with or without a legal entity status; (3) they are independent companies, which means that they are not owned by a large company, nor are they directly or indirectly affiliated with a large enterprise (Government of Indonesia, 2008).

The following sections describe the research instrument and its internal validity, the sampling strategy used, the respondents who participated in the research, the data collection strategy as well as the data analysis methods.

6.2 Research Instrument

Our study, aimed at explaining the phenomenon of firms' knowledge absorption and the interaction of these organizations with their environment, required a suitable research instrument, which was a questionnaire. The questionnaire was developed on the basis of the literature review as discussed previously (see Chapter 2, Chapter 3, and Chapter 4).

The questionnaire consisted of six parts. The *first part* contained questions about demographic topics related to the owner/manager, such as age, gender, educational background, working experience, and allocated time for managing the firm. The *second part* covered questions about demographic issues associated with the firm, such as age, location, status, and location, the manager and establisher of the firm, the time available to the firm to grow, its monthly revenues, and the number of employees.

Table 6.1. Questions about the stickiness of external knowledge

No.	*Questions*	*Likert scale*
1	*Content and depth of the knowledge (interconnected),* 39 items Based on your experience within the past two years, please indicate the specific knowledge content (i.e., a) design/products; b) process (i.e., raw material, production process, equipments/technology); c) organizational (i.e., markets and supervision/management) you obtained from external sources: 1) buyers; 2) suppliers; 3) competitors; 4) consultants; 5) government offices; 6) industry associations; 7) religious affiliations; 8) university/research institutions; 9) exhibition; 10) magazines/newspapers; 11) television; 12) radio; and 13) the Internet. Please also indicate the depth of the knowledge per domain.	1=very little, 5=very much
2	*Sensory knowledge*, 13 items How easily can you show or demonstrate within your firm the knowledge you received from 1) buyers; 2) suppliers; 3) competitors; 4) consultants; 5) government offices; 6) industry associations; 7) religious affiliations; 8) university/research institutions; 9) exhibition; 10) magazines/newspapers; 11) television; 12) the radio; and 13) the Internet.	1=very easy, 5=very difficult
3	*Coded knowledge*, 13 items How easily can you write down in terms of manuals, instruction guides and procedures, knowledge from 1) buyers; 2) suppliers; 3) competitors; 4) consultants; 5) government offices; 6) industry associations; 7) religious affiliations; 8) university/research institutions; 9) exhibition; 10) magazines/newspapers; 11) television; 12) the radio; and 13) the Internet.	1=very easy 5=very difficult
4	*Theoretical knowledge*, 13 items Within your firm, how easily can you explain the knowledge – in terms of why and how – obtained from 1) buyers; 2) suppliers; 3) competitors; 4) consultants; 5) government offices; 6) industry associations; 7) religious affiliations; 8) university/research institutions; 9) exhibition; 10) magazines/newspapers; 11) television; 12) the radio; and 13) the Internet.	1=very easy, 5=very difficult

Source: Content of knowledge was adopted from Porter (1985); Kristiansen et al. (2003); and Jorna (2006). Sensory, coded, and theoretical knowledge were adopted from Cijsouw and Jorna (2003).

The questions of *the third part* dealt with the stickiness of external knowledge. They covered the topics of content as well as type of external knowledge, as summarized in Table 6.1 (see Appendix A for details).

The *fourth part* consisted of questions about interaction, referring to the mode and frequency of interaction (see Table 6.2).

Table 6.2. Questions about interaction

No.	*Interaction*	*Scale*
1	*Interaction with direct individual parties* How often does your firm interact with 1) buyers; 2) suppliers; 3) competitors; 4) consultants, and in what way? a) formal direct meeting; b) informal direct meeting; c) telephone; d) paper/facsimile e) email	1=Occasionally 2= Monthly 3= Weekly 4= Several times a week 5= Daily
2	*Interaction with direct institutional parties* How often does your firm interact with 5) government offices; 6) industry associations; 7) religious affiliations; 8) university/research institutions, and in what way? a) formal direct meeting; b) informal direct meeting; c) telephone; d) paper/facsimile; and e) email	1=Occasionally 2= Monthly 3= Weekly 4= Several times a week 5= Daily
3	*Interaction with indirect sources* 1. How frequently do you attend exhibitions?	1= Never 2= Once in a year 3= Twice in a year 4= Three times in a year 5= More than three times in a year
	2. How many hours a day does your firm access magazines/newspapers? 3. How many hours a day does your firm access television? 4. How many hours a day does your firm access the radio? 5. How many hours a day does your firm access the Internet?	1= Never 2= Less than 30 minutes 3= About one hour 4= Two hours 5= More than two hours

Source: Based on Appleyard (1996)

The *fifth part* covered questions about absorptive capacity, which included the dimensions initiatives and innovations (see Table 6.3).

The *last part* of the questionnaire consisted of questions about obstacles (i.e. financial, level of complexity of the knowledge, physical distance, and foreign language) to absorb knowledge from the external environment (Smith, 2005; Van Geenhuizen and Indarti, 2005).

From July until August 2007 a pilot study was conducted in order to ensure the understandability, usability, and validity of the answers. Based on the pilot study, we adapted some terms as well as the sequence of a few questions. The final and complete version of the questionnaire is attached in Appendix A.

Table 6.3. Questions about absorptive capacity

No	Questions
	Dimension of potential absorptive capacity (6 items)
1	How often are initiatives[20] taken for new product innovations?
2	How often are initiatives taken for new process innovations?
3	How often are initiatives taken for new organizational innovations?
4	How often are initiatives taken for modified product innovations?
5	How often are initiatives taken for modified process innovations?
6	How often are initiatives taken for modified organizational innovations?
	Dimension of realized absorptive capacity (19 items)
1	How often are new product innovations realized?
2	How often are new process innovations implemented?
3	How often are new organizational innovations implemented?
4	How often are modified product innovations realized?
5	How often are modified process innovations implemented?
6	How often are modified organizational innovations implemented?
7	Our firm accepts demand which goes beyond existing products and services
8	We invent new products and services
9	We experiment with new products and services in our local market
10	We commercialize products and services that are completely new to our unit
11	We frequently utilize new opportunities in new markets
12	Our firm regularly uses new distribution channels
13	Lowering the costs of the internal processes is an important objective
14	We frequently refine the provision or conditions of our current products and services
15	We regularly implement small adaptations to our current products and services
16	We regularly improve our current products and services
17	We regularly improve the efficiency of the provision or conditions of our products and services
18	We increase economies of scale in existing markets
19	We expands ours services for our current clients

Note: Measured using 5-point Likert-scale: 1=seldom and 5=very often. Questions no. 1-6 of both potential and realized absorptive capacity were adopted from Johannessen et al., (2001); Van Geenhuizen and Indarti (2005). Questions no. 7-19 were adopted from Jansen et al., (2006)

6.2.1 Internal validity of the instrument

As discussed above (see Section 6.2), the questions of the research instrument were developed on the basis of previous studies (see Table 6.1, Table 6.2, and Table 6.3). In our study, we used Cronbach's alpha value to examine the internal consistency of the instrument. For all constructs the values of Cronbach's alpha were higher than 0.60 (see Table 6.4). As Nunally (1978) suggests, values of 0.50 up to 0.60 can be considered acceptable. Therefore we concluded that the items to measure the knowledge interconnectedness, sensory knowledge, coded knowledge, theoretical knowledge, interaction, and

[20] Initiatives are all ideas, plans, and programs discussed within a firm which are documented in written reports, although they are less formal.

absorptive capacity were acceptable, which meant that they would provide consistent results.

Table 6.4. Internal validity of the research instrument

No.	*Construct*	*Items*	*Alpha*
1	Interconnectedness of knowledge	39	0.94
2	Sensory knowledge	13	0.81
3	Coded knowledge	13	0.81
4	Theoretical knowledge	13	0.83
5	Interaction	13	0.89
6	Absorptive capacity	25	0.88
7	Potential absorptive capacity	6	0.83
8	Realized absorptive capacity	19	0.84

We note here that the higher the scores of alpha for knowledge interconnectedness, sensory, coded, theoretical knowledge and interaction are not unexpectedly (see Table 6.4). This indicates that the items/questions we used in the survey consist of the same construct and the respondents were consistent on their answers.

6.3 Sampling Strategy

6.3.1 Respondents

The target group of this study was formed by the owners/managers of SMEs in two industries: the furniture and the software sectors in Indonesia. Next, we will explain why we chose these two sectors.

First, in the case of SMEs, the owners or managers are the main actors in charge of and responsible for the firms' growth and innovation, while all information goes to these people (Stanworth and Curran, 1976; Tidd et al., 2005) (see Chapter 2 and Chapter 3). Therefore, by studying the owners/managers' perceptions, information is obtained on the organization as a whole.

Second, the furniture and software sectors in Indonesia mainly consist of "make-to-order manufacturing" (Van Geenhuizen et al., 2010) or "buyer driven chain" businesses (Gereffi, 1999). These firms produce a high variety of products in relatively low quantities, which are manufactured in accordance with customer designs and specifications (Hendry, 1998). Generally, furniture and software firms operate on a make-to-order basis because of the nature of their products and their relationships with their buyers (Hadi, 1991; Bruell, 2003).

Third, as aforementioned, furniture firms represent less knowledge-intensive organizations and software firms more knowledge-intensive businesses (see

Chapter 3 and Chapter 5). As this study concentrates on the absorptive capacity concept, and particularly the use of external knowledge in the context of innovation at an organizational level, selecting the owners/managers of furniture and software manufacturing firms as the participants in our research was a logical choice. Further, in order to obtain a broader picture in terms of the knowledge base, our research included actors involved in innovation, and the relevant institutions involved (Malerba, 2005). These dimensions were required to gain an insight into innovation and its differences in the two sectors (Malerba, 2005). The next subsection explains the criteria used to select the SMEs.

6.3.2 Sampling techniques

To ensure that the respondents would match the objective of our study, we used a *judgment sampling technique* (Cooper and Schindler, 2008) which provided us with a number of criteria. The businesses participating in our study had to be 1) furniture and software manufacturing firms which had existed for more than 2 years, and 2) firms which employed less than 100 people (see Section 6.1).

With respect to the furniture sector, the province of Yogyakarta, with its high density of furniture SMEs, was selected as our research site. A spatial analysis performed in a previous study (Kuncoro, 2000) indicates that Yogyakarta is one of the cities on the island of Java where relatively many SMEs are clustered. In addition, Yogyakarta is considered as one of the main visiting places for handicraft and furniture buyers in Indonesia (Raharjo, 2009). Although also the city of Jepara is well-known as a location of leading furniture firms in Indonesia, presently the importance of Yogyakarta has increased because it functions as a passage way for visitors to reach other nearby cities, such as Semarang, Jepara, and Senenan (Raharjo, 2009). However, to ensure the representativeness of the sample, the respondent firms were selected from different locations spread across the Province of Yogyakarta, with various characteristics in terms of their products, size, and age.

Unlike the furniture industry, the Indonesian software sector is still in its early years. The vast majority of SME software developer firms in Indonesia are concentrated in large cities (Donny and Mudiardjo, 2006). In this study, we selected Bandung, Yogyakarta, Surabaya, and Malang, where many software firms are located, as the main research sites (see Figure 6.1). These four cities are known in Indonesia as the main locations of institutions of higher education, such as universities[21], where the number of potential start-ups is relatively high

[21] Some big universities in the cities selected are: Institut Teknologi Bandung, Institut Teknologi Nasional, Universitas Padjajaran (Bandung); Universitas Gadjah Mada, Universitas Negeri Yogyakarta, Universitas Islam Indonesia (Yogyakarta); Universitas Airlangga, Institut Teknologi

(Rahardjo, 2002). The higher education institutions train thousands of software engineers every year. In addition, Bandung and Surabaya are known as industrial cities where many high technology and telecommunication firms are located. Also in these cities a great deal of technological off-spring and networks are generated (Rahardjo, 2002). By choosing these cities (Yogyakarta, Bandung, Surabaya and Malang) as our research sites we expect to have a representative sample.

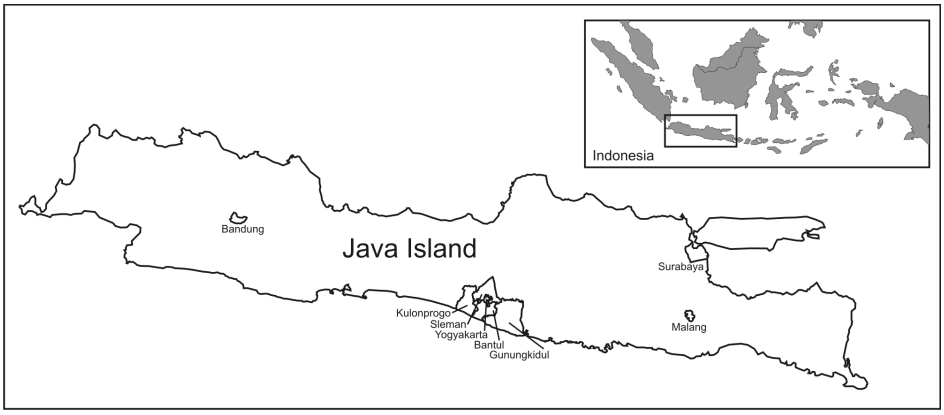

Figure 6.1. Research sites

We have to add that many SMEs in Indonesia operate without a legal basis. According to data from The Indonesian Statistics Bureau (www.bps.go.id), this is typical of Indonesian SMEs which can be classified as home industries or family businesses. When selecting the firms in our sample we used the Databases from the Business Directory of the Indonesian Department of Industry and Trade. For the furniture firms we also used a database of the Indonesian Furniture Industry and Handicraft Association (*Asosiasi Industri Permebelan dan Kerajinan Indonesia, Asmindo*). In obtaining software firms we additionally addressed databases from the Association of Indonesian Software Developers (*Asosiasi Pengembang Piranti Lunak Indonesia, Aspiluki*) and the Internet (www.indonetwork.net).

Since not all furniture and software firms are listed in the databases, we gathered additional information by following a 'snowballing' procedure: participating respondents suggest other relevant companies. Snowballing' is a common methodology used in the following cases: 1) when no comprehensive data are available (Cooper and Schindler, 2008); 2) when the participating

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Sepuluh Nopember, Universitas Surabaya (Surabaya); Universitas Brawijaya, Universitas Negeri Malang, Universitas Muhammadiyah Malang (Malang).

respondents have access to extensive personal and informal networks, and 3) when a recommendation from a former respondent makes it easier to approach a potential new participant (Souitaris, 2001).

6.4 Data Collection Procedure

The data were collected from October 2007 until March 2008 by means of personal face-to-face interviews with the firms' owner-directors or other (top) managers. During the interviews, assistants helped the respondents fill out the questionnaire, which took 45-60 minutes on average. If an interview could not take place, we used the "drop and collect" procedure by having the respondents fill out the questionnaire by themselves. Afterwards, upon collection of the questionnaire the completeness of the answers was checked. All (100%) the returned questionnaires were filled completely by the respondents and were included in the next data analysis.

The group of assistants consisted of undergraduate and master students who were sufficiently equipped to collect data. They were students of a reputable university in the city where the data collection was conducted (Institut Teknologi Sepuluh Nopember in Surabaya, Universitas Muhammadiyah Malang in Malang, Institut Teknologi Bandung in Bandung, and Universitas Gadjah Mada in Yogyakarta).

Table 6.5. Sample of the study

	Furniture firms	*Software firms*	*Total*
Small size (<=19)	71	84	155
Medium size (<=99)	27	16	43
Large size (>=100)	2	-	2
Total	100	100	200

Out of the 265 software firms we contacted, 132 (49.81%) were either closed down or less than two years in operation. The rest (133) was considered to be eligible for participating in the research. Of this group, 33 firms were not willing to participate in the research. In total, 100 questionnaires were filled out, which accounted for a 75.2% response rate. As regards the furniture firms, out of 322 on the list, 168 were not eligible to participate as respondents because they had been operating for less than two years and were now engaged in the handicraft business. Of the rest of the firms (154), 100 were willing to partake in the study, resulting in a response rate of 64.9%. The total number of returned questionnaires was 200, of which 198 represented small and medium sized firms and two came from large companies (see Table 6.5). No clear patterns were identified in the non-response. Mostly the non-responders were not willing to

participate due to various reasons, such as a lack of time or other engagements at the time of the data collection. The 198 sample firms which were considered as suitable for analysis will be described in more detail in Chapter 7.

6.5 Data Analysis Methods

The data obtained from the questionnaires were tabulated, and because all questions were closed-ended ones, they had to be analyzed by using a statistical software package (SPSS). In view of the quantitative nature of this study, this software was required for performing several statistical analyses and tests.

In addition to the descriptive analysis (mean and variance) to examine the relations among variables, we conducted a means comparison using a t-test, cross tabulation, and multiple regression analysis. A means comparison using a t-test is performed when a variable has to be compared between two groups on the basis of a certain condition, and this variable has to be compared on an interval or ratio measurement level, such as for example between two sectors (furniture and software) and among groups of knowledge sources (direct individual, direct institutional, and indirect).

When both variables are on a nominal or ordinal measurement level, cross-tabulation is applied using Chi-square to measure the significance of the relationship, such as for example between the intensity of interaction and the source of knowledge.

6.6 Conclusion

This chapter presented our research plan, which forms the basis for the formulation of the research questions and the elaboration of the sample procedures in the following chapters. We adopted a quantitative approach which mainly consisted of survey research focused on furniture and software firms in Indonesia. As explained in this chapter, our main research instrument (the questionnaire) was tested and checked to ensure its credibility and consistency. Further, we introduced our sampling strategy, the data collection procedure, and the methods of analysis. The descriptive statistics and testing of the hypotheses will be discussed in the next chapter.

7. Empirical Findings

7.1 Introduction

This chapter discusses the empirical findings gathered in the furniture and software sectors in Indonesia. The discussion includes a demographic overview of the firms and their owners, the characteristics of knowledge (domains and types), the nature of the interaction (parties, frequency, and media), and the firms' absorptive capacity (i.e., activities, initiatives, and innovation). In addition, the results of the hypotheses testing are presented. In the final section, we will formulate our conclusions.

7.2 Demographic Overview

As summarized in Table 7.1, the majority of the respondents of the two sectors are male (86.7% in the furniture and 94.0% in the software sector). The average age of the firms' owners is 36 years old. In general, the owners of the furniture firms (age 40) are older than those of the software firms (age 32). The vast majority of the respondents (79.3%) are well-educated people with a university level educational background (62.2% for the furniture firms and 96.0% for the software companies).

This finding indicates that generally the software industry requires higher competences and more formal education than the furniture industry. The interviews show that many of the software firms we approached were established when the owners were still undergraduates studying at universities. Quite often, a firm was established by a group of students (see Table 7.2) who were planning to continue the organization in a more professional way after their graduation.

The furniture firms show a different picture. Here, many owners started their businesses when they were still in senior high school. When they entered the university, they continued to run their companies simultaneously. On average, the furniture firms had been in operation for 11 years at the time of our research, while most of them were run by people with a university background (62.2%) (see Table 7.2).

Table 7.1. Demographic aspects of the owners

Variable	*Furniture firms*		*Software firms*		*Both sectors*	
	n	%	*n*	%	*n*	%
Gender						
- Male	85	86.7	94	94.0	179	90.4
- Female	13	13.3	6	6.0	19	9.6
Educational level						
- Not completed until junior high school	6	6.1	0	0	6	3.0
- Senior high school	31	31.6	4	4	35	17.7
- University	61	62.2	96	96	157	79.3
Working experience						
- Never	27	27.6	20	20.0	47	23.7
- Yes	71	72.4	80	80.0	151	76.3
Working sector*						
- Public	5	5.1	8	8.0	13	8.6
- Private	44	44.9	53	53.0	95	62.5
- Self-employed	24	24.5	23	23.0	47	30.9
Main business						
- Yes	89	90.8	70	70.0	159	80.3
- No	9	9.2	30	30.0	39	19.7
Full time for company						
- Yes	81	82.7	59	84.3	140	88.1
- No	8	8.2	11	15.7	19	11.9

Note: *Multiple answers are allowed; then more > 198.

Furthermore, the educational level of 36.62% of the furniture firms' employees is junior high school education or lower, while 45.35% have a senior high school education, and 18.03% a university background. To the software sector applies that 82.18% of the employees have a university background, while the rest has had a senior high school education (16.92%) or lower (0.91%).

With respect to the knowledge intensive firms, we explained in Chapter 3 and Chapter 5 that this type of organizations is led by well-educated people and that the business climate is of an intellectual nature (Alvesson, 2004). Here qualified employees (with a good educational background) form the major part of the workforce (Alvesson, 2004). Alvesson provides an indicator of knowledge intensity based on the level of extent of education. The findings of our study are in line with our proposition that software firms are more knowledge intensive, whereas furniture firms are less knowledge-intensive.

Before starting their firms, many owners (76.3%) in our study had worked in various other sectors. In the case of the furniture firms, most respondents had been active in the private sector (44.0%) and only a few (5.1%) in the public sector. Similarly, as much as 80.0% of the software firm's owners already had prior work experience before starting their businesses, mostly (53.0%) in the private sector, while 23.0% was self-employed. To almost all respondents (80.3%) of both sectors

applies that their current business forms their core activity. However, 88.1% of these participants do not run their firms on a full-time basis (see Table 7.1). As the figures indicate, 82.7% of the owners of the furniture firms and 84.3% of the owners of the software firms are working full-time. As was expected, most firms (76.3%) are managed by the owner of the firm (see Table 7.2). With respect to the management of the software firms, colleagues or friends are considered the most important co-actors (76.0%). As regards status, most furniture (96.0%) and software (94.0%) companies in the sample are independent, which is a typical characteristic of small firms (Government of Indonesia, 2008), as shown in Table 7.2.

Table 7.2. Demographic aspects of firms

Variable	*Furniture firms*		*Software firms*		*Both Sectors*	
	n	%	*n*	%	*n*	%
Status						
- Independent	96	98.0	94	94.0	190	96.0
- Subsidiary	2	2.0	6	6.0	8	4.0
Location						
- Urban/town	26	26.5	90	90.0	116	58.6
- Suburban	36	36.7	9	9.0	45	22.7
- Village	36	36.7	1	1.0	37	18.7
Firm's growth after its establishment						
- Within 2 years	61	62.2	70	70.0	131	66.3
- After 2 years	37	37.8	30	30.0	67	33.8
Initiator*						
- Your self (the owner)	81	82.7	79	79.0	161	80.8
- Parents	13	13.3	2	2.0	15	7.6
- Relatives	16	16.3	1	1.0	18	8.6
- Friends	5	5.1	35	35.0	40	20.2
Managing the firm*						
- Myself	89	90.8	62	62.0	151	76.3
- Family	38	38.8	20	20.0	58	29.3
- Colleagues/friends	24	24.5	76	76.0	100	50.5
- Employee	13	13.3	2	2.0	16	8.1
Monthly revenue (IDR million)						
- < = 100 (EUR 7,702[22])	85	86.8	89	89.0	174	87.9
- > 100	13	13.2	11	11.0	24	12.2

Note: *Multiple answers are allowed.

One of the main characteristics of software business is that they do not need much space or the business can be performed in a relatively small space. Also in our sample almost all software firms are located in a town or an urban area, while only one is situated in a rural area. Furniture firms, on the other hand need much more space for their production processes. It is therefore not surprising that the furniture

[22] www.xe.com, accessed on 30 January 2010.

firms in our sample are mainly located in suburban areas (36.0%) and in villages (36.0%).

Although the number of employees sometimes varies between the two sectors, the average number of employees of SMEs in Indonesia is about 15 people (The Indonesian Statistic Bureau, www.bps.go.id). On average, the number of employees of the furniture firms in our sample is 20, while that of the software firms is 10. In addition, we found that on average, the lifespan of furniture firms (11 years) is longer than that of software firms (6 years).

In SME settings, particularly in developing countries such as Indonesia, a firm's owner is always the initiator of new business ventures, which also applies to the owners of the firms we studied. They were found to be the most important actors with respect to initiating new activities (80.8%). As regards the establishment of businesses, most (82.7%) furniture firms appear to have been initiated by their owners. Similarly, as Table 7.2 shows, a large proportion (79.0%) of the software firms is also initiated by the owner, followed by friends (35.0%). After their establishment, the firms' growth rate may vary. In general, we found that 66.3% of the firms in the two sectors started to expand within 2 years of their existence.

The survey also goes into the market focus of the firms studied. The furniture firms target both domestic and export markets, while the software firms, one of the emerging businesses in Indonesia, concentrate most on domestic markets. As summarized in Table 7.3, 52.61% of the furniture firms' revenues are made in the domestic market and 47.39% in the export market. The firms export their products to destinations all around the world, such as the Netherlands, Germany, Spain, France, England, Australia, Japan, South Korea, China, and Malaysia.

The software firms largely depend on the domestic market (95.43%) for their revenues. Only 4.57% of their total revenues come from the export market (see Table 7.3). The information systems and computer applications developed for the domestic market are meant for the private users (51.80%), government (21.49%), education (17.90%), and healthcare (7.31%) sectors. The monthly net revenues of the vast majority (87.0%) of the firms in the two sectors are less than IDR 100 million (EUR 7,702).

As regards sources of capital (see Table 7.3), personal savings are found to be the most common (75.26%) among the furniture firms, followed by joint capital owned with friends/colleagues (8.37%) and family investments (7.91%). This picture also applies to the software firms, however, with different percentages: 51.58% for personal savings, 31.75% for joint capital, and 7.78% for family investments. Only a small percentage of both the furniture and the software firms utilize loans/shares from banks as their sources of capital. Self-reliance is one of the typical

characteristics of SMEs in developing countries, including Indonesia (Kristiansen et al., 2005; Wattanapruttipaisan, 2003). They rely heavily on their own resources and only rarely interact with banks (Kuncoro, 2008; Wattanapruttipaisan, 2003). Like in other developing countries, in general, SMEs in Indonesia avoid using commercial banks for their payroll management and other day-today working accounts for various reasons: lack of fixed assets as collateral, lack of a sound business plan as well as lack of personal guarantor or mutual guarantee fund for loans (see Wattanapruttipaisan, 2003).

Table 7.3. Target market and type of investments

Item	*Furniture firms*	*Software firms*
Target markets (%)		
- Domestic markets	52.61	95.43[a]
- Export markets	47.39	4.57
Type of investment (%)		
- Personal saving	75.26	51.58
- Family investment	7.91	7.78
- Joint capital with friends/colleagues	8.37	31.75
- Bank	6.84	3.06
- Others	1.63	5.83

Notes: [a]Detailed percentage domestic markets for the software firms: a) Education 17.90%; b) Healthcare 7.31%; c) Government 21.49%; d) Private 51.80%, and e) Others 1.50%.

7.3 The Stickiness of External Knowledge

In this study, the stickiness of external knowledge is examined from two perspectives: the content/domains of knowledge and the types of knowledge (see Chapter 3 and Chapter 5). These perspectives will be discussed in the following subsections. Section 7.3.1 deals with the dominant domains of knowledge and the interconnectedness of the knowledge obtained from the various sources. Section 7.3.2 addresses the dominant types of absorbed knowledge (sensory, coded and theoretical).

7.3.1 Sources and domains of external knowledge

As discussed in the previous chapters (Chapter 3, Chapter 4 and Chapter 6), the producers of knowledge are classified into three groups based on the nature of their interaction with the firm, namely: direct individual, direct institutional, and indirect sources of knowledge (see Table 7.4). The content/domains of knowledge are classified into product, process, and organizational domains, which correspond with the type of initiatives/innovations (product, process, and organizational, as summarized in Table 7.5). In this section, we will discuss the dominant domain and interconnectedness of the knowledge absorbed by the furniture and the software firms.

Table 7.4. Groups of knowledge sources

Group	*Sources of knowledge*
Direct individual	Buyers Suppliers Competitors Consultants
Direct institutional	Government offices Industry associations Religious affiliations Research institutions
Indirect	Exhibitions Magazines/newspapers Television Radio Internet

Note: For a detailed discussion see Chapter 4.

Table 7.5. Groups of knowledge domains

Group	*Domains of knowledge*
Product	Design/product
Process	Raw material Production process Equipment/technology
Organization	Markets Administration/management

Source: Adopted from Porter (1985); Kristiansen et al., (2005); Jorna (2006).

As can be seen in Table 7.6, we found that the product domain is the most dominant in terms of the knowledge absorption by both sectors (the furniture firms: mean=1.22, the software firms: mean=1.34). Knowledge regarding the product domain is the most frequently absorbed from direct individual sources. As expected, both the furniture and the software firms absorb only a limited amount of knowledge from direct institutional parties. The furniture firms indicated that direct individual parties are their most important knowledge sources, while the software firms rely the most on indirect knowledge providers (see Table 7.6).

From the perspective of the furniture firms, buyers are the predominant knowledge providers, followed by exhibitions/magazines, and the Internet (see Table B.1 in Appendix B). For the software firms the Internet forms the most important knowledge source, followed by buyers. Surprisingly, to both the furniture and the software firms applies that the role of suppliers in providing knowledge domains is relatively small compared to that of buyers (see Table B.1 in Appendix B). However, in the case of the furniture firms the suppliers form the most important providers of knowledge about the process domain. Manufacturing firms usually rely heavily on their suppliers, especially in connection with the availability of raw

material. Additionally, we found that the radio is perceived as the least important knowledge source.

Table 7.6. Dominance of knowledge domains

Source	*Furniture firms*			*Software firms*		
	Product	*Process*	*Organizational*	*Product*	*Process*	*Organizational*
Direct individual	1.57	0.98	0.81	1.67	1.18	1.32
Direct institutional	0.44	0.36	0.51	0.69	0.58	0.66
Indirect	1.57	0.79	0.89	1.61	1.44	1.32
All	1.22	0.72	0.75	1.34	1.09	1.12

Note: Knowledge domain ranging from 0= no knowledge domains, 1=a few knowledge domains to 5=a lot of knowledge domains.

In this study, we define the interconnectedness of knowledge as the number of various domains to which the knowledge provided by external sources refers (Simon 1976; Van der Spek and Spijkervet, 1997; Jorna, 2006). A method to calculate the scores of interconnectedness is explained in Method 7.1.

Method 7.1. Calculation of the scores of the interconnectedness of knowledge

The scores of interconnectedness are determined by establishing (a) the number of knowledge domains provided by a source of knowledge, and (b) the depth of the knowledge provided about the domain (see Table 7.5). The average score of the domains represents the depth of the knowledge provided, ranging from 1 to 5. A score of 0 (null) means that the source does not provide any knowledge about a particular domain. A score of 1 that a source provides some knowledge about a domain, and a score of 5 that the source supplies a great deal of knowledge about a domain.

Let us consider another case with the following domain scores: 1, 1, and 2. Here the average is 1.33 (i.e., 4/3=1.33). In this case, the number of knowledge domains provided is 3. Hence, the score of interconnectedness is 1.33 * 3/3 = 1.33. Table 7.7 provides some more examples.

Table 7.7. Calculation of the knowledge interconnectedness scores

No	*Depth of knowledge*			*Number of domains provided*	*Average*	*Score of interconnectedness*
	Product	*Process*	*Organizational*			
1	0	0	0	0	0.00	0.00
2	5	0	0	1	1.67	0.55
3	0	5	0	1	1.67	0.55
4	0	0	5	1	1.67	0.55
5	2	3	0	2	1.67	1.11
6	1	1	2	3	1.33	1.33
7	4	1	1	3	2.00	2.00
8	5	5	5	3	5.00	5.00

For example, when buyers have provided knowledge about product, process, and organizational domains with a knowledge depth score of 5, 0, 0, respectively (case #2) as perceived by firm A, the score is considered equal to the score in the case of firm B, which is 0, 0, 5 (case #3) (see Table 7.7). In both cases, the number of knowledge domains provided is 1, knowledge about a product domain in case #2 and knowledge about an organizational domain in case #3, and the average is the same (i.e., 5/3 = 1.67). The score of knowledge interconnectedness is then 1.67 * 1/3 = 0.55 (the average multiplied by the number of domains provided and divided by the number of possible domains).

Table 7.8 shows a general picture of fairly low interconnectedness scores for both the furniture and the software firms. The software firms perceive a higher degree of interconnectedness (mean=1.13) than the furniture firms (mean=0.80). Given the characteristics of the source groups (see Chapter 4), our findings show that the knowledge obtained from direct institutional sources is the least interconnected. On the other hand, the knowledge provided by indirect sources shows the highest level of interconnectedness as perceived by both the furniture and the software firms.

Table 7.8. Interconnectedness of knowledge

Source	*Interconnectedness*	
	Furniture firms	*Software firms*
Direct individual	0.97	1.31
Direct institutional	0.39	0.61
Indirect	0.99	1.40
All	0.80	1.13

Note: Scores of interconnectedness ranging from 0=not at all, 1= very low to 5=very high.

More specifically, as far as the furniture firms are concerned the knowledge provided by the buyers is the most interconnected, followed by exhibitions and the Internet (see Table B.2 in Appendix B). The radio, on the other hand, scores the lowest on interconnectedness, followed by religious affiliations. In the context of the software firms, the knowledge from the Internet scores the highest on interconnectedness, followed by the knowledge from buyers. Further, the software firms perceive the knowledge provided by religious affiliations and the radio as the least interconnected. These knowledge sources obtained the lowest scores.

With regard to the stickiness of knowledge, as discussed in Chapter 3 and Chapter 5, the higher the score of its interconnectedness, the more accessible the knowledge, and thus the less sticky it is. According to our findings, both the furniture and the software firms perceive the knowledge obtained from direct institutional sources as more difficult to absorb. In general, we can conclude that the stickiness of external knowledge as perceived by these two sectors is relatively high. However, the interconnectedness of the knowledge obtained by the software

firms is of a higher level than that provided to the furniture firms. This finding indicates that knowledge coming from external sources is accessed and absorbed more easily by the software firms than by the furniture firms. This means that the stickiness of knowledge is more of a problem for the furniture firms than for the software firms, since in the case of the latter its level is lower.

Additionally, to both sectors applies that the buyers and the Internet are the most dominant sources of knowledge (for the product domain), providing the highest levels interconnectedness. On the other hand, the radio and religious affiliations had the lowest scores on interconnectedness. In summary, knowledge provided by buyers and the Internet is the least sticky, whereas that obtained from the radio and religious affiliations is the stickiest. It appears that with respect to acquiring knowledge, small firms are more inclined to approach and interact with external parties/sources with which they are acquainted (Fann and Smeltzer, 1989). We also found that knowledge from direct institutional sources is the most difficult to absorb as compared to the other sources. This fact may be related to the characteristics of these sources (formal form of interaction, see Chapter 4). We can therefore conclude that the knowledge provided by direct institutional sources has the highest level of stickiness.

7.3.2 Types of external knowledge

In this study, external knowledge has been classified into three types, namely sensory, coded and theoretical knowledge (see Chapter 3 and Chapter 5). In this section we will first discuss the predominant type of knowledge as absorbed by the furniture and software firms. Second, each knowledge type is discussed in detail. The scores of the three knowledge types are calculated as explained in Method 7.2.

Method 7.2. Calculation of dominant type of knowledge

The scores of sensory, coded, and theoretical knowledge are calculated by averaging the scores of each source of knowledge as perceived by the firm. The score of sensory knowledge ranges from 1=less sensory to 5=more sensory, that of coded knowledge from 1=less coded to 5=more coded, and that of theoretical knowledge from 1=less theoretical to 5=more theoretical.

The dominant type of knowledge absorbed by a firm is determined per knowledge source group (direct individual, direct institutional, and indirect). When a particular knowledge type is provided by more than one group, this is the dominant type. When each group provides a different type of knowledge, the dominant type is the one with the highest score (see Table 7.9).

Table 7.9. Categorization of dominant type of knowledge

Group sources	*Type of knowledge i.e. sensory, coded, theoretical*			*Dominant type*
	Direct individual	*Direct institutional*	*Indirect*	
Firm A	Sensory	Sensory	Coded	Sensory
Firm B	Coded	Theoretical	Coded	Coded
Firm C	Sensory	Theoretical	Coded	Sensory*

Note: *Based on the highest scores. In this case, for instance, sensory knowledge has the highest score.

Based on this calculation, we can establish that the two sectors corresponding identical patterns of knowledge absorption (see Table 7.10). These patterns are determined by sensory knowledge (44.90%) in the case of the furniture firms, and coded knowledge (42.00%) in the case of the software firms. In the case of the furniture firms, the sensory knowledge is mostly provided by direct individual sources (50.52%), while the software firms mostly obtain their coded knowledge from direct institutional sources (56.34%).

Difference in the patterns of knowledge adsorption between the two sectors in terms of knowledge focus may be related to the nature of the businesses. In the furniture sector, most knowledge required is practical know-how (Polanyi, 1960), for example about how to make a table, how to cut/connect wood effectively, and how to preserve it. The tasks and activities in this sector require the imitation of already existing approaches and methods, which are best transferred by means of sensory knowledge (Jorna, 2006).

Table 7.10. Types of knowledge absorbed

Dominant type	*Furniture firms (%)*			*Software firms (%)*		
	Sensory	*Coded*	*Theoretical*	*Sensory*	*Coded*	*Theoretical*
Direct individual	50.52	24.74	24.74	44.44	36.36	19.19
Direct institutional	42.62	37.70	19.67	36.62	56.34	7.04
Indirect	42.86	23.08	34.07	42.42	40.40	17.17
All sources	44.90	27.55	27.55	38.00	42.00	20.00

Software firms, however, require the use of codes, such as scores, schemes, and formulae for their business activities (for example creating new software). Similar to other SMEs elsewhere, the software businesses in Indonesia are mainly 'make-to-order manufacturing' companies (Van Geenhuizen and Indarti, 2008; Gereffi, 1999, see Chapter 6). A crucial requirement for this type of organizations is that they can develop products that meet the exact specifications as defined by their buyers (Hendry, 1998). The buyers of these firms usually provide detailed information about the products ordered, for example by means of pictures, textual concepts, or formulae. In this context, coded knowledge is the most suitable information and therefore the predominant knowledge type in this sector. Here the other types of

knowledge are absorbed to a much lesser degree (see Table 7.10). The following subsections discuss each type of knowledge in more detail.

7.3.2.1 Sensory knowledge

Sensory knowledge is knowledge which is particularly dependent on its context and can only be obtained through imitation (see Chapter 3 and Chapter 6). From the perspective of the recipient, sensory knowledge can range from less to more sensory. A *paired samples t-test* showed that in both sectors the knowledge obtained from direct individual sources (mean=3.48, SD=0.84) is perceived as the most sensory information (see Table 7.11). Further, the software firms perceive the knowledge obtained from indirect sources as more sensory (mean=3.39, SD=0.83) than the furniture firms do (mean=3.34, SD=0.84). All in all, the furniture firms consider the direct individual sources as the providers of the most sensory knowledge (mean=3.62, SD=0.86) compared to the other sources (see Table 7.11).

The *independent samples t-test* also indicated that the furniture firms (mean=3.62, SD=0.86) perceive the knowledge obtained from direct individual sources as significantly more sensory ($t=2.27$, $p<0.05$) than the software firms (mean=3.35, SD=0.80). Likewise, the furniture firms also (mean=3.44, SD=0.76) perceive the knowledge obtained from indirect sources as significantly more sensory ($t=1.67$, $p<0.10$) than the software firms (mean=3.27, SD=0.70) (see Table 7.11). We can therefore conclude that for the furniture firms, external knowledge is more sensory than for the software firms. This means that to the furniture firms the external sensory knowledge is less accessible than to the software firms. In other words, we can conclude that with respect to this knowledge type the furniture firms perceive higher levels of stickiness than the software firms.

Table 7.11. Sensory knowledge

Source of knowledge	*Both sectors*		*Furniture firms*		*Software firms*		t^b
	Mean[a]	*SD*	*Mean*	*SD*	*Mean*	*SD*	
Direct individual	3.48	0.84	3.62	0.86	3.35	0.80	2.27 **
Direct institutional	3.02	1.01	3.18	0.97	2.88	1.04	1.64
Indirect	3.37	0.83	3.34	0.84	3.39	0.83	-0.33
All	3.35	0.73	3.44	0.76	3.27	0.70	1.67 *
Mean comparison	Direct individual> Indirect> Direct institutional***		Direct individual > Direct institutional*** Direct individual> Indirect***		Direct individual> Direct institutional*** Indirect> Direct institutional***		

Notes:
[a] Measured using a 5-point Likert scale (1=less sensory and 5=more sensory)
[b] For a mean comparison between the two sectors
* $p<0.1$, ** $p<0.05$, *** $p<0.01$

Knowledge obtained from the Internet (mean=3.90, SD=0.95) is perceived as the most sensory by both sectors, followed by knowledge obtained from buyers (mean=3.66, SD=0.97) (see Table B.3 in Appendix B). As indicated, sensory knowledge is dependent on its context and can only be obtained through imitation (Jorna, 2006). For example, when buyers order a particular outdoor table and chairs made of mahogany wood, they provide the company with a detailed description of the model, including the preferred size, colors, and shape. They may also provide pictures. Based on this information, the furniture firm manufactures the product. However, it happens only seldom that these buyers provide information on how to process the raw material, in this case the mahogany wood. Another example: when software firms address the Internet to obtain information on particular software, practical know-how about the software itself and the programming language are often very hard to come by, except for open source software. This lack of contextual information makes it more difficult for the software developers to imitate the manufacturing processes and produce similar software. This finding may be explained by the nature of the knowledge provided by these sources. It is generally perceived that this knowledge provides only little contextual references and clues for imitation.

Surprisingly, the external knowledge from the radio and the television is regarded as the least sensory. Knowledge provided by the radio is transferred by sound, while the television sends sounds and images to its receivers (Crisell, 1986). From the perspective of both the furniture and the software firms, the knowledge offered by these sources is the most accessible compared to that of other providers. The ubiquitous quality of these sources may explain this accessibility. However, in spite of the transparency of the knowledge provided by these sources (of which that of the radio is perceived as the least sensory knowledge and therefore the easiest to absorb), the current study shows that the furniture and the software firms only rarely address these sources for obtaining knowledge in the product, process, and organizational domains (see Section 7.3.1 and Table B.1 in Appendix B).

7.3.2.2 Coded knowledge

Knowledge can be represented in various kinds of codes, ranging from weakly- to strongly-coded (see Chapter 3 and Chapter 5). The *paired samples t-test* showed that both sectors obtain the least coded knowledge (mean=3.01, SD=1.12) from direct institutional sources (see Table 7.12). In the case of the furniture firms, direct individual sources provide knowledge which is significantly more coded (mean=3.70, SD=0.92) compared to that of direct institutional sources (mean=3.45, SD=0.96). The software firms, on the other hand, perceive the knowledge from the indirect sources (mean=3.35, SD=0.85) as significantly more

coded than the information provided by the direct individual sources (mean=2.65, SD=1.13).

Table 7.12. Coded knowledge

Source of knowledge	*Both sectors*		*Furniture firms*		*Software firms*		t^b
	Mean[a]	*SD*	*Mean*	*SD*	*Mean*	*SD*	
Direct individual	3.42	0.98	3.70	0.92	3.15	0.96	4.00 ***
Direct institutional	3.01	1.12	3.45	0.96	2.65	1.13	4.14 ***
Indirect	3.50	0.89	3.65	0.90	3.35	0.85	2.35 ***
All	3.37	0.85	3.61	0.85	3.15	0.79	3.88 ***
Mean comparison	Direct individual> Direct institutional *** Indirect> Direct institutional ***		Direct individual> Direct institutional * Indirect> Direct institutional *		Indirect> Direct individual> Direct institutional ***		

Notes:
[a] Measured using a 5-point Likert scale (1= less coded and 5=more coded)
[b] For a mean comparison between the two sectors
* $p<0.1$, ** $p<0.05$, *** $p<0.01$

Furthermore, the furniture and the software firms indicated that the information supplied by the buyers (mean =3.66) and the Internet (mean=4.05) is the most coded (see Table B.4 in Appendix B). The more coded the knowledge, the more accessible it is to be absorbed (see Chapter 3). This finding is in line with the previous conclusion that buyers and the Internet are the most dominant sources of knowledge in this study (see Section 7.3.1). The radio provides the least coded knowledge of all sources. As discussed in Chapter 3, the weaker the code, the more ambiguous the knowledge (Jorna, 2006). The radio is considered as a *blind medium* (Crisell, 1986:3), which means that people cannot see its messages; it merely consists of sound and silence. This characteristic makes knowledge from the radio more difficult to understand and transfer clearly to others. The information is more susceptible to ambiguity and may lead to paradoxical communication (Bateson et al., 1956).

By performing an *independent samples t-test*, we found that the furniture firms absorb knowledge which is significantly ($t=3.88$, $p<0.01$) more coded than that obtained by the software firms (see Table 7.12). The high level of complexity of the new knowledge as perceived by the software firms may explain this finding. The software firms experience the issue of highly complex knowledge (mean=1.87, SD=1.33; 1=very little, 5=very high) as a more severe problem than the furniture firms do (mean=1.36, SD=1.29)[23]. The interviews with the owners/managers of the furniture firms indicated that the external knowledge used (from buyers) by these

[23] For a detailed discussion on obstacles for absorbing external knowledge, see Section 7.5.

organizations is the form of codes, such as pictures/icons. So when a buyer orders a certain model of a table/chair, s/he generally provides pictures rather than textual descriptions. In the software context, the Internet is the most important source (see Section 7.3.1) with respect to all knowledge domains. From the interviews with the owners of the software firms we learned that the knowledge absorbed from the Internet generally has the form of scores, texts, and formulae, for instance in the case of programming language or in descriptions of information systems to be developed. Table 7.13 supports this argument.

Table 7.13. Forms of coded knowledge absorbed

Form of coded knowledge	*Direct individual*	*Direct institutional*	*Indirect*	*Total*
Furniture firms (%)				
Icons/pictures	27.83	11.11	42.47	31.16
Diagrams	3.04	11.11	7.72	6.52
Schemes	19.57	33.33	12.74	19.10
Texts/speech	35.22	37.96	27.03	32.16
Formulae	14.35	6.48	10.04	11.06
Software firms (%)				
Icons/pictures	13.36	7.86	18.30	14.41
Diagrams	8.78	10.00	6.21	7.91
Schemes	29.01	33.57	19.28	25.71
Texts/speech	37.79	31.43	30.39	33.33
Formulae	11.07	17.14	25.82	18.64

Furthermore, the highest percentage of the coded knowledge absorbed by the furniture (32.16%) and the software (33.33%) firms has the form of text/speech (see Table 7.13). Next, the proportion of coded knowledge absorbed in the form of icons/pictures is higher for the furniture firms (31.16%) than for the software firms (14.41%). However, the software firms absorb a higher percentage of coded knowledge in the form of formulae (18.64%) than the furniture firms (11.06%). In addition to interaction in the form of text/speech, the furniture firms and the external parties may communicate with the help of icons/pictures, such as pictures of tables or chairs ordered by the buyers. These forms of coded knowledge can be exchanged during exhibition events, or they can appear in newspapers/magazines. On the other hand, the software firms gather their coded knowledge, for instance from the Internet, in the form of formulae. The nature of the two businesses explains this finding.

As aforementioned, we found that the furniture firms absorb more coded knowledge than the software firms do. The findings presented in Table 7.13 could mean that the forms of coded knowledge should be interpreted differently. Although one would expect that formulae are theoretically more coded (Jorna, 2006), the findings indirectly show that the furniture firms consider icons/pictures

as more coded. This may also be because the types of icons/pictures absorbed by the two sectors may differ. From the interviews we learned that the pictures of the products provided to the furniture firms have generally clear dimensions and scalable formats, which are less ambiguous and therefore easier to understand, while this does not apply to the software firms. The fact that information consisting of formulae is less common in the furniture sector may also be a reason why icons and pictures are perceived as more coded. Theoretically, however, formulae are considered as the most coded knowledge. This interpretation may explain our finding that the furniture firms obtain more coded knowledge in the form of icons and pictures than the software firms. The more coded, the less ambiguous, and therefore the more accessible the knowledge. In short, the level of stickiness of external knowledge in terms of coded knowledge is higher for the software firms than for the furniture firms.

In summary, we can conclude that the coded knowledge obtained by the furniture and the software firms differs from one knowledge source group to another. The direct institutional sources supply the least coded knowledge, whereas the indirect sources provide the most coded information. The coded knowledge absorbed by the furniture firms is mostly in the form of text/speech, icons/pictures, and schemes. The software firms mainly absorb their coded knowledge in the form of text/speech, schemes, and formulae.

7.3.2.3 Theoretical knowledge

In this study, theoretical knowledge refers to the degree to which it can be explained in terms of abstractness, referring to its complexity and the length of its causal chains. Theoretical knowledge ranges from less to more theoretical (see Chapter 3 and Chapter 6). The longer the why-connection, the more theoretical the knowledge. The *paired samples t-test* showed that the degree of theoretical knowledge provided by the source groups differs significantly (see Table 7.14). The knowledge supplied by direct institutional sources is significantly the least theoretical (mean=3.08, SD=1.01) compared to that offered by the other sources. On the other hand, we found that knowledge obtained from direct individual sources (mean=3.55, SD=0.93) is the most theoretical.

In the case of furniture firms, the knowledge obtained from buyers (mean=3.91, SD=0.88) is the most theoretical knowledge, followed by the Internet (mean=3.90, SD=0.87) (see Table B.5 in Appendix B). For the software firms, our research showed that the knowledge from the Internet (mean=4.05, SD=0.86) is the most theoretical, followed by that obtained from buyers (mean=3.64, SD=1.09). The interviews with the owners of the firms in the two sectors told us that the production of the goods is generally based on the information provided by the

buyers who ordered them (Gereffi, 1998). Often, the contents of this information lack detail and are not explained properly, which makes the knowledge more theoretical. Likewise, the knowledge from the Internet often contains various knowledge domains, which also increases its complexity. Since the knowledge absorbed from these sources is considered to have a longer why-chain, it is more theoretical.

Table 7.14. Theoretical knowledge

Source of knowledge	*Both sectors*		*Furniture firms*		*Software firms*		t^b
	Mean[a]	*SD*	*Mean*	*SD*	*Mean*	*SD*	
Direct individual	3.55	0.93	3.78	0.84	3.33	0.97	3.39 ***
Direct institutional	3.08	1.01	3.35	0.99	2.85	0.97	2.87 ***
Indirect	3.51	0.92	3.63	0.97	3.40	0.88	1.73 *
All	3.46	0.86	3.63	0.86	3.29	0.83	2.86 ***
Mean comparison	Direct individual> Direct institutional *** Indirect> Direct institutional ***		Direct individual> Indirect> Direct institutional ***		Direct individual> Direct institutional *** Indirect> Direct institutional ***		

Notes:
[a] Measured using a 5-point Likert scale (1= less theoretical and 5=more theoretical);
[b] For a mean comparison between the two sectors;
* $p<0.1$, ** $p<0.05$, *** $p<0.01$

The radio (mean=2.51, SD=1.19) and religious affiliations (mean=2.83, SD=0.95) are perceived as the source groups providing the least theoretical knowledge (see Table B.5 in Appendix B). The more theoretical the knowledge, the less accessible it is (Jorna, 2006, see Chapter 3). Therefore, knowledge from buyers and the Internet is considered to be highly complex, which makes it less accessible for the firms in both sectors. In contrast, because of its ubiquitous nature and relative simplicity, the information provided by the radio is perceived as the easiest of all knowledge forms to both access and absorb.

Furthermore, the *independent samples t-test* showed an interesting finding from all the knowledge groups. It appears that the furniture firms generally perceive the knowledge provided to them as significantly more theoretical ($t=2.86$, $p<0.01$) than the software firms, regardless of which knowledge source group (see Table 7.14). In other words, the furniture firms have more difficulty in absorbing theoretical knowledge from their environment than the software firms, which means that the knowledge absorbed is perceived as stickier by the furniture firms than by the software companies. The educational background of the employees in the software sector may play a role here (see Section 7.2). As discussed in Chapter 3, theoretical knowledge is generally associated with well-educated people (Jorna, 2006). Most owners and employees of software firms have a university background,

which makes them more capable of absorbing knowledge with a higher degrees of complexity than the owners and employees of furniture firms, whose education levels are generally lower (see Table 7.1). This finding supports our argument that the software companies are more knowledge-intensive and the furniture firms less knowledge-intensive organizations (see Chapter 3 and Chapter 5).

Based on the abovementioned findings, we can conclude that furniture firms consider the external knowledge which they absorb as more theoretical than the software firms do. This is why from their perspective external knowledge is more difficult to absorb and therefore less accessible than in the case of the software firms. The knowledge provided by direct institutional sources is generally perceived as less theoretical and hence more accessible. Therefore, the companies in both sectors consider the knowledge supplied by the radio and religious facilitations as the least theoretical. Hence, in their view this knowledge is the most accessible to absorb. On the other hand, the knowledge offered by buyers and the Internet is experienced as the most theoretical, and therefore as the least accessible.

7.3.3 Knowledge space

Based on the findings presented in Section 7.3.2, we developed a knowledge space for both sectors, based on our basic discussion of this construct (see Chapter 3). In this study, we made a small adaptation to the knowledge space, as depicted in Figure 7.1. The knowledge space shows that the furniture firms absorb external knowledge which consists of more sensory (mean=3.44, SD=0.76), more coded (mean=3.61; SD=0.85), and more theoretical (mean=3.63, SD=0.86). In the case of software firms, the external knowledge is perceived as less sensory (mean=3.27, SD=0.70), less coded (mean=3.15, SD=0.79), and less theoretical (mean=3.29, SD=0.83).

The findings indicate that the furniture firms consider the sensory and theoretical knowledge they absorb as stickier than the software firms do. On the other hand, the software firms consider the coded knowledge they absorb as stickier than the furniture firms do. In other words, the software firms have a higher degree of accessibility to absorb sensory and theoretical knowledge compared to the furniture firms. These findings imply that external knowledge with respect to the various types of knowledge have a different impact for the firm's recipient. One firm, for example, may consider a particular type of knowledge as less sticky than another firm. Internal conditions, such as knowledge access facilities within the firm, may have an influence in this context.

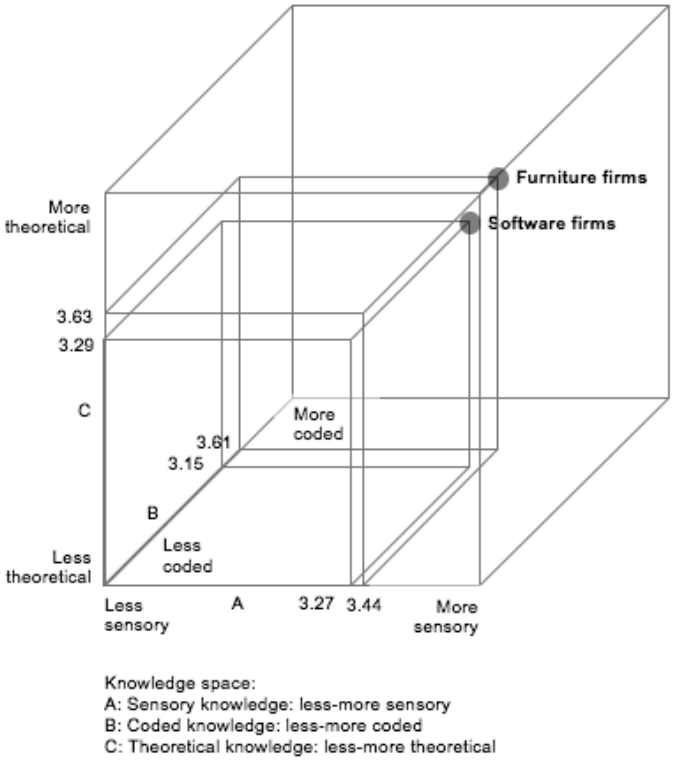

Figure 7.1. An adapted knowledge space

7.4 Interaction among firms

7.4.1 Interaction among parties and its frequency

In this study we have divided the parties involved in the interaction with the knowledge seekers into three groups, namely direct individual, direct institutional, and indirect knowledge sources (see Chapter 4). In general the research shows that both the furniture and the software firms interact the most intensively with direct individual knowledge sources (see Table 7.15). The intensity of the interaction, however, is significantly higher for the furniture firms ($\chi^2=6.05$, df$=2$, $p<0.05$) than for the software firms. On the other hand, the interaction of the software firms with indirect sources is significantly more intensive ($\chi^2=17.39$, df$=2$, $p<0.05$) than that of the furniture firms with this type of knowledge providers.

More specifically, our findings show that the intensity (frequency) of interaction with producers of knowledge differs between the two sectors (see Table B.6 in Appendix B). The software firms interact with their buyers significantly ($\chi^2=10.82$,

df=2, $p<0.01$) more frequently than the furniture firms. Although the percentage of interaction (98.0%) is the same for both sectors, the level of intensity of this interaction is higher in the case of the software firms.

Table 7.15. Frequency of interaction

Source	*Furniture firms (%)*			*Software firms (%)*			χ^2
	Never	*Seldom*	*Often*	*Never*	*Seldom*	*Often*	
Direct individual	34.69	30.61	34.69	37.00	43.00	20.00	6.05 **
Direct institutional	72.45	26.53	1.02	65.00	31.00	4.00	2.48
Indirect	36.73	63.27	0.00	22.00	64.00	14.00	17.39 ***

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

On the other hand, compared to the software firms, the furniture firms interact significantly more intensively with their suppliers ($\chi^2=10.02$, df=2, $p<0.01$). This can be explained by the nature of the furniture industry, which relies heavily on the availability of raw material (e.g., high quality wood). This is why suppliers are more relevant to furniture firms than to software firms. However, although the interaction between furniture firms and their suppliers is intensive, it is not specifically aimed at absorbing knowledge (see Section 7.3.1) but rather on supporting the firms' production process in the form of providing raw materials (such as wood and nails).

As regards the interaction with direct institutional parties, our findings show that the software firms (51.0%) interact more frequently with research institutions/universities than the furniture firms (16.0%) do (see Table B.6 in Appendix B). This picture complies with the condition where most of the software firms are located in the town/urban area where most of the research institutions/universities reside (see Table 7.2). In contrast, the majority of the furniture firms in our sample are located in sub-urban and villages that make them physically far away from access to the research institutions/universities. We also find that 86.7% of these firms have never accessed the radio (see Table B.6 in Appendix B), which is now less attractive than accessing other medias such as television.

Surprisingly, the majority of the furniture firms (83.0%) and the software firms (82.0%) have never interacted with religious affiliations to get knowledge. This finding is not inline with findings of the previous study on furniture firms in a smaller town in Indonesia (Van Geenhuizen and Indarti, 2008). Although in the Indonesian context where the collectivistic aspect of culture is highly dominant (Hofstede, 1991), and where religious activities are embedded in the societal context (Candland, 2000), the current study indicates that the existences of religious groups do not provide the relevant knowledge for the furniture and the software firms. Different context of society or location may explain this finding.

These findings confirm the previous results (see Section 7.3.1), which indicate that the two knowledge sources of research institutions/universities and religious affiliations are the least dominant for both sectors. Given the difficulty of gaining access to or absorbing the knowledge supplied by these providers (see Chapter 4), it is not surprising that neither the furniture nor the software sector interacts with these parties in an intensive way (see Section 7.3.2.1).

In summary, it does appear from the study's findings that the furniture and the software firms more frequently interact with informal sources, such as buyers and suppliers, than with formal sources, such as research institutions, government offices, and religious affiliations (Peterson, 1988; Smeltzer et al., 1988).

Furthermore, of all indirect knowledge sources the Internet is accessed the most frequently by both sectors. All software firms access the Internet at least approximately 30 minutes a day, and 62.0% of the furniture firms regularly address this source. Apart from functioning as one of the most important knowledge sources (see Section 7.3.1), the Internet is also an efficient medium of knowledge transfer (Baron, 2003), by means of, for example email (Caloghirou et al., 2004). So the advantages of the Internet are twofold: it is a suitable tool for knowledge adsorption and it enables its users to save considerable time and money by providing a quick and easy access to relevant information (Walcszuch et al., 2000; Hisrich and Peters, 1998) as discussed in Chapter 4.

Based on the explanation above, we can conclude that both the furniture and the software firms interact the most intensively with their buyers and that the Internet is their most prominent knowledge source. This finding is in line with the fact that the majority of the furniture and software SMEs in Indonesia are largely dependent on their buyers for the information required by these organizations in their production processes (Van Geenhuizen and Indarti, 2008; Gereffi, 1999). So for both sectors the buyers are the most dominant group of knowledge providers. This explains why, in comparison with the other knowledge sources discussed, the buyers' interaction with the SMEs studied is the most intensive (see Section 7.3.1). This finding supports those of previous studies (Lehtimaki, 1991; Reid, 1993). For example, Lehtimaki (1991) established that of all knowledge providers, small SMEs in Finland interact the most intensively with their buyers in the exploration and development of new ideas for product innovations. In addition, Reid (1993) claims that technology- and innovation-oriented firms in the UK consider buyers as their predominant knowledge providers.

7.4.2 Channels of interaction used

Aside from the participants (the knowledge seekers and the knowledge sources), another important element in the interaction process is formed by the various

knowledge channels. We distinguished two types: traditional channels (formal and informal meetings) and non-traditional channels (technology-based channels, such as telephone, paper/facsimile, and email (see Chapter 4).

In their interaction with the various knowledge providing parties, the furniture as well as the software firms generally use both traditional and non-traditional channels (see Table 7.16). We note that the two types of channels are not complementary, which means that firms may use both channels equally intensively.

With respect to the interaction with direct individual knowledge sources, we found that the furniture firms use the traditional channels significantly ($\chi^2=5.86$, df=2, $p<0.1$) more intensively than the software firms do. More specifically, after applying a Chi-square test to the traditional and non-traditional channels used, we observed that when interacting with buyers, the software firms make a more intensive use of both traditional ($\chi^2=13.65$, df=2, $p<0.01$) and non-traditional channels ($\chi^2=6.24$, df=2, $p<0.05$) than the furniture firms do. However, when interacting with suppliers, the use of both traditional ($\chi^2=28.79$, df=2, $p<0.01$) and non-traditional channels ($\chi^2=7.88$, df=2, $p<0.05$) is significantly more intensive in the case of the furniture firms (see Table B.7 in Appendix B).

Table 7.16. Channels used in interaction

Source	*Furniture firms (%)*			*Software firms (%)*			χ^2
	Never	*Seldom*	*Often*	*Never*	*Seldom*	*Often*	
Direct individual							
- Traditional	17.35	39.80	42.86	32.00	35.00	33.00	5.87 *
- Non-traditional	53.06	31.63	15.31	36.00	44.00	20.00	5.86 *
Direct institutional							
- Traditional	63.27	31.63	5.10	67.00	26.00	7.00	0.96
- Non-traditional	81.63	17.35	1.02	66.00	31.00	3.00	5.87 *

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

However, regarding the interaction with direct institutional sources, there are no differences in the use of the traditional channels between the two sectors. Non-traditional channels, however, are used significantly more intensively by the software firms ($\chi^2=5.87$, df=2, $p<0.1$) as compared to the furniture firms.

In addition, we observed differences in the degree of formality (formal or informal meetings) in the firms' interaction with external parties (see Table 7.17). The interaction with direct individual parties takes more frequently place by means of informal meetings rather than by formal ones. On the other hand, in the case of interaction with direct institutional parties, the communication is more frequently established through formal meetings. These findings apply to both the furniture and the software firms.

Table 7.17. Use of interaction media

Source	Furniture firms (%)			Software firms (%)			χ^2	
	Never	Seldom	Often	Never	Seldom	Often		
Direct individual								
- Formal meeting	31.63	45.92	22.45	33.00	49.00	18.00	0.61	
- Informal meeting	25.51	42.86	31.63	31.00	43.00	26.00	1.07	
- Telephone	17.35	25.51	57.14	33.00	36.00	31.00	14.27	***
- Paper/facsimile	51.02	35.71	13.27	43.00	47.00	10.00	2.65	
- E-mail	60.20	25.51	14.29	33.00	38.00	29.00	15.24	***
Direct institutional								
- Formal meeting	61.22	36.73	2.04	64.00	33.00	3.00	0.44	
- Informal meeting	73.47	22.45	4.08	67.00	27.00	6.00	1.07	
- Telephone	69.39	24.49	6.12	67.00	30.00	3.00	1.65	
- Paper/facsimile	82.65	16.33	1.02	68.00	30.00	2.00	5.71	*
- E-mail	81.63	17.35	1.02	66.00	27.00	7.00	8.10	**

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

Further, the use of the telephone is more common among the furniture firms than among the software firms, while facsimile and e-mail are more frequently used by the software firms than by the furniture firms. These findings are substantiated by the fact that all the software companies (100%) access the Internet more than earlier 30 minutes (see Table B.6 in Appendix B), while this applies to only 18% of the furniture firms (see also Section 7.4.1).

In summary, we conclude that the furniture firms use traditional channels more frequently than the software companies. Regarding the degree of formality, informal face-to-face meetings are more frequently conducted in interaction with individual parties, while formal face-to-face meetings are more common in the interaction with institutional parties. Our research indicates that in the interaction between the furniture and the software firms and the external parties, face-to-face meeting is the most common communication medium used. This finding may be explained by the characteristics of the face-to-face meeting, which facilitates a higher level of social contact between the sender and the receiver of the information (Heiman and Nickerson, 2004). Additionally, this type of interaction is characterized by a high degree of interactivity, whereby the knowledge is transferred directly and the chances of communication bias or paradoxical communication are reduced (Bateson et al., 1956).

7.5 Absorptive Capacity

As discussed in Chapter 2, we defined absorptive capacity as the capability to absorb knowledge from the external environment, and to utilize this knowledge in the realization of innovative outputs. In the context of this study, we measured a firm's absorptive capacity in terms of its innovation activities. This section discusses

several aspects of innovation in the furniture and the software sectors, which include the actors in the innovation process, the level of innovative change, and the number of initiatives and innovations realized.

7.5.1 Actors in innovation

We have categorized the various actors in the process of innovation within a firm into three groups: internal, external individual, and external institutional actors (see Table 7.18). The internal actors are the owner/manager and the employees. The external individual actors include buyers, suppliers, competitors, and consultants. The external institutional actors are represented by government offices, university/research institutions, industry associations, and religious affiliations.

Table 7.18. Actors of innovation

Actors	*Both sectors*	*Furniture firms*	*Software firms*	*t*
Internal (i.e., employee of the firm)	3.26	2.89	3.57	-0.67***
External individual	3.18	3.20	3.15	0.35
External institutional	2.39	2.32	2.45	0.79

Note: *Measured using 5- Likert scales ranging from 1= less important to 5= very important

In the context of the furniture and the software sectors, the internal actors (the owner/employee) are the most important initiators of innovation policies. Additionally, only 14.0% of the furniture firms and 37.0% of the software firms have an R&D department, while the remaining firms do not have any R&D facilities in this respect (see Table 7.19). These findings indicate that with respect to the issue of innovation the vast majority of SMEs rely heavily on internal actors (the owner). Tidd et al. (2005) argue that the owners/managers of SMEs are the actors mainly responsible for the organization's policies (innovation). Additionally, a highly educated owner/manager is the most important determinant of innovation activity (Hoffman et al., 1998).

Table 7.19. R&D department

Item	*Both sectors*		*Furniture firms*		*Software firms*	
	n	%	*n*	%	*n*	%
R&D innovation department						
1. Yes	51	25.8	14	14.3	37	37.0
Number of employees*						
a. Less than 5 persons	48	84.9	10	71.4	34	91.8
b. 5 persons and more	7	13.7	4	28.6	3	8.1
2. No	147	74.2	84	85.6	63	63.0

Note: * Percentage taken from firms with an R&D department

Apart from the internal actors (owner, employees), external individual actors, especially buyers and competitors, play an equally important role in supporting the innovation policies within the two sectors studied (see Table B.8 in Appendix B).

This result is consistent with the previous finding (see Section 7.3.1) that buyers form the most relevant source of knowledge to both sectors. The significant role of this group may be explained by the nature of the furniture and software businesses (production-based on order, see Hendry, 1998) and the position of the buyers, who have a direct impact on the firms' performance in terms of manufacturing innovative high quality products/services. If these products no longer meet the standards as agreed upon, the buyers will not hesitate to reject them. This evidence supports the assumption of the open innovation paradigm as introduced by Chesbrough (2004), who argues that firms should make use of both internal (employee) and external sources (buyers) to generate additional value (see Chapter 3).

Consequently, if a firm's fails to meet the requirements of its buyers with respect to the development of innovative products, this will also affect the organization's employees. Further, competitors have a unique role in stimulating innovation. Generally, the introduction of innovative products by competitors is a threat to the other firms in terms of their market position. In order to safeguard this position, these organizations also have to innovate and adapt their products. This horizontal interaction with competitors gives companies the opportunity to gain an insight into their know-how (Linn, 1994) and develop even better products (Inkpen and Pien, 2006).

On the other hand, to both the furniture and the software firms the external institutional actors appear to be the least relevant parties with respect to the stimulation of innovation policies. Therefore, they are the least dominant source of knowledge for both sectors (see Section 7.3.1). Moreover, as far as the furniture and the software firms are concerned government offices are hardly focused on improving their possibilities in the field of innovation (see Table B.8 in Appendix B).

Most furniture and software firms face serious obstacles in gaining access to new knowledge in the innovation process. With regard to the nature of these barriers, financial obstacles are the severest ones reported (see Table 7.20) especially among the software firms. This situation may be explained by the high costs associated with obtaining access to external knowledge. In this respect, the financial means of the firms in the two sectors are similar in terms of their monthly revenue (see Table 7.2).

The severest problems faced by the software firms are the complexity of the new knowledge, the fact that a large part of the new knowledge is in a foreign language, and the large physical distance to the knowledge sources. The furniture enterprises perceive the language problem as the severest barrier, followed by financial obstacles, the complexity of the new knowledge, and the large physical distance to

the knowledge sources. The higher educational background of the owners and the employees of the software firms may explain why foreign language is not the major problem of the software companies (see Section 7.2).

Table 7.20. Obstacles to access external knowledge

Obstacle	*Both sectors*		*Furniture firms*		*Software firms*		t^b
	Mean[a]	*SD*	*Mean*	*SD*	*Mean*	*SD*	
Financial obstacles	2.00	1.58	1.73	1.71	2.26	1.40	-2.37 ***
Complexity of new knowledge	1.62	1.33	1.36	1.29	1.87	1.33	-2.76 ***
Physical distance to knowledge source	1.18	1.36	1.29	1.46	1.07	1.25	1.11
Knowledge available in foreign language	1.55	1.62	1.79	1.84	1.32	1.33	2.04 **

Notes:
[a] Measured using a 5-point Likert scale (1=very little and 5=very high);
[b] For a mean comparison between the two sectors;
* $p<0.1$, ** $p<0.05$, *** $p<0.01$

In summary, with respect to the furniture and software SMEs in our study, we can conclude that R&D plays a relatively small role in the support of these organization's innovation policies, because in general these activities are initiated by their owners or managers. To conclude, buyers are the most important actors in the stimulation of firms' innovation projects. Furthermore, limited financial resources are the severest obstacles faced by the firms.

7.5.2 Initiatives and innovation

As discussed previously, we have measured absorptive capacity in terms of innovation. In this section, the aspects of innovation that include initiatives, type of innovation, and the degree of change are discussed.

7.5.2.1 Frequency

Table 7.21 shows the frequency of the initiatives and the actual realization of innovations within 2 years (for both the furniture and the software firms). In general, we can see that software firms plan innovations significantly more frequently than they actually implement them, which indicates that not all initiatives lead to successful innovations. This phenomenon is called the innovation funnel (Wheelwright and Clark, 1992). Factors playing a role here are generally a lack or financial resources and a shortage of skilled workers (Freel, 2000; Rothwell, 1994), as discussed in Chapter 2.

However, the opposite applies to the furniture firms. It appears that these firms often realize their innovations on the spot without any extensive preparation in the form of plans. This can be explained by the fact that the production of new furniture is often based on the specific orders from the buyers. These orders may

require the firm to use different raw materials or more sophisticated technology/equipment, or to adapt their production process.

Table 7.21. Frequency of initiatives and innovations

Type	*Furniture firms*					*Software firms*				
	Initiatives[a]		*Innovations*[a]		*t*	*Initiatives*		*Innovations*		*t*
	Mean	*SD*	*Mean*	*SD*		*Mean*	*SD*	*Mean*	*SD*	
Product	2.81	1.47	3.07	1.36	2.59**	3.19	1.09	2.85	1.09	-3.91***
Process	1.95	1.63	2.04	1.46	0.75	2.77	1.14	2.52	1.22	-2.59**
Organizational	1.46	1.52	1.32	1.38	-1.60	2.04	1.29	1.82	1.24	-2.76***
All	2.07	1.31	2.14	1.13	0.92	2.66	0.84	2.40	0.88	-3.98***

Note: [a] Measured by a 5-Likert scale from 1=seldom to 5=very often
* $p<0.1$, ** $p<0.05$, *** $p<0.01$

Of all three types of innovation (product, process, and organizational), the current study shows that product innovation is the most dominant (see Table 7.21). Examples of types of innovation are summarized in Table 7.22. The dominance of product innovation may be attributed to the specific nature of the furniture and the software industries. In order to meet the ever-changing demands of the customers associated with these sectors, the keyword for these firms is product differentiation. Both the furniture and the software companies are typical manufacturing firms, which means that their main focus in on making products. In addition, given the fact that most SMEs in developing countries, including Indonesia, are often faced with a lack of skills and technology (Tsang, 1999, see Chapter 3), they are mainly focused on primary activities[24], especially product-related activities. This is why their main objective is the introduction of new, improved, and high quality products (Subrahmanya et al., 2010). Product innovation clearly has a more direct impact on the revenues of these firms than process and organizational innovation (see Subrahmanya et al., 2010; Roper, 1997). Subrahmanya et al., (2010) emphasize the importance of product innovation in creating a greater share in total sales of a firm in manufacturing SMEs in India. Similarly, in the case of German, UK and Irish SMEs, Roper (1997) finds that the output of innovative SMEs grew significantly faster than that of non-innovators as an implication of the products innovation that contributes to the faster growth of the former. SMEs are more dependent on the introduction of product innovations as part of their competitive strategy than large firms (Fritz, 1989). Therefore, SMEs are more inclined to focus on product innovation rather than on process innovation, which is, however, also important (Hoffman et al., 1998).

[24] Activities which are focused on the transformation of input into commercial output.

Table 7.22. Examples of innovation

Type of innovation	*Furniture firms*	*Software firms*
Product innovation	Indoor (colonial table/chair, bed, drawer, cupboard, sofa); Outdoor furniture (table/chair)	Academic information systems; Accounting information systems; Library information systems; Inventory information systems
Process innovation	Introducing alternative wood as raw material instead of teak-wood; Applying new methods/introducing new production machinery	Applying new algorithms; Applying a new programming language
Organizational innovation	Restructuring the organization; Implementing a book-keeping system; Expanding new markets and distribution channels	Restructuring the organization; Implementing book-keeping system; Using new promotion techniques

Moreover, the literature on organizational innovation indicates that the majority of firms that decide to reengineer their managerial systems and the way in which they organize their business are the larger ones (Van Geenhuizen and Indarti, 2005). This may explain the relatively low level of organizational innovation in our sample. Another explanation may relate to the typical Indonesian culture, of which uncertainty avoidance is an important characteristic (Hofstede, 1991). A society with a large focus on uncertainty avoidance tends to avoid any form of risk, which is inherent in organizational innovation.

In summary, we conclude that product innovation is the most dominant type of innovation among the Indonesian furniture and software firms. This finding supports previous studies that were conducted in a developing country setting (Kristiansen et al., 2005; Van Geeinhuizen and Indarti, 2005). Kristiansen et al., (2005) report on the dominance of product innovation over process and organizational innovation among small garment and furniture firms in Tanzania. A recent study by Van Geenhuizen et al. (2010) shows a similar finding in the context of very small furniture firms in Indonesia.

7.5.2.2 Degree of change

Innovation can be classified in terms of the degree of change, which can be subdivided into radical or exploratory and incremental or exploitative innovation (see Chapter 2). We note that the degree of change, whether radical or incremental, is relative and dependent on the perspective of the firms. An innovation considered as radical by one firm may be incremental in the eyes of another firm (Tidd et al., 2005). As shown in Table 7.23, the furniture and the software firms in Indonesia generate incremental innovations as well as major breakthroughs (Hoffman et al., 1998).

As regards the type of innovation (radical or incremental), both the furniture and the software firms are mainly engaged in incremental innovation activities (see Table 7.23). This picture contradicts the basis premise that SMEs are established to exploit new or radical innovations (Simon et al., 2002). However, in the context of SMEs in a developing country such as Indonesia, this finding was to be expected and it is understandable. Due to their nature and characteristics, SMEs are not well capable of yielding radical outputs, since their main activities are not defined internally but externally (by buyers and competitors, see Section 7.5.1). From interviews with the owners of the firms we studied we learned that a lack of resources (financial, technical, infrastructure, and management) is an important reason why these companies are reluctant to initiate radical innovations, which are inherently associated with higher risks due to the amount of resources required. Additionally, our study confirms a previous study by Oke et al., (2007) who studied growing SMEs in the UK. This study indicates that also here there is a greater focus on incremental innovation than on radical innovation.

Table 7.23. Degree of change

Changes	*Radical*		*Incremental*		*t*
	Mean[a]	*SD*	*Mean*	*SD*	
Furniture firms	2.66	0.88	2.78	0.87	-1.79*
Software firms	2.76	0.72	3.09	0.75	-5.66***
Both sectors	2.71	0.80	2.94	0.82	-5.05***

Note: [a] Measured by a 5-Likert scale ranging from 1=seldom to 5=very often
* $p<0.1$, ** $p<0.05$, *** $p<0.01$

Based on the above discussion (see Section 7.5.2.1 and Section 7.5.2.2), we may conclude that the levels of innovativeness attained by the furniture and the software SMEs in Indonesia are relatively modest (see Table 7.21 and Table 7.23). The study's findings suggest that most of the firms in the two sectors are mainly engaged in product innovation as a strategy for growth and survival in sectors which are dominated by frequent changes in the area of product and design (Van Geenhuizen et al., 2010). Be that as it may, most of the innovations introduced by the firms in our sample show low levels of change in terms of newness. Our results confirm the earlier premises regarding the position of the furniture and the software SMEs at the end of the value chain.

7.6 Hypotheses Testing

7.6.1 Operationalization of the Variables

1. Independent variables: stickiness of knowledge and interaction

Independent variables of this study are stickiness of external knowledge and interaction. The items used to measure stickiness and interaction are taken from previous studies (see Table 6.1 and Table 6.2 in Chapter 6). The final score of each

stickiness component was calculated by averaging all scores of their 13 items. The score of interaction is calculated by averaging all scores of the knowledge 13 sources.

2. Dependent variable: absorptive capacity

Absorptive capacity is measured by the two dimensions, namely PACAP (initiatives) and RACAP (innovations) as summarized in Table 7.24.

Table 7.24. Dimensions of absorptive capacity

No.	*Dimension*	*Measurement*	*Aspect*
1	PACAP	Initiatives (6 items)	Frequency of initiatives to introduce product, process, and/or organizational innovation(s), including both new and modified innovations.
2	RACAP	Innovations (19 items)	Frequency of actual product, process, and/or organizational innovation(s), including both new and modified innovations.

Note: The items to measure initiatives and innovations were described in Chapter 6 (see Table 6.3).

3. Moderating variables: a firm's age and size

In our analysis of the effect of the moderating variables, the firms will be grouped into two categories per variable. Table 7.25 summarizes the operationalization of these variables. Subsequently, the means of each variable is used as the categories' cut-off points.

Table 7.25. Measurement of moderating variables

Moderating variables	*Measurement*	*Source*
Age	Number of years passed since firm's establishment	Kimberly (1976)
Size	Number of employees	Da Rocha et al. (1990); Heunks (1998)

7.6.2 Regression analysis results

This section presents the results of the analysis of the relationships between the independent variables and the dependent variable. Before conducting the regression analysis, we deployed a Pearson's correlation test to check for a possible correlation between PACAP and RACAP. The correlation coefficient (r) between these two dimensions appeared to be 0.69 ($p<0.05$), which could be considered as a significantly high correlation[25]. This figure indicated that there was a strong relationship between PACAP and RACAP.

In addition, an exploratory factor analysis was performed on the basis of 25 items that were used to measure PACAP and RACAP by means of a principal

[25] Coefficient correlations close to -1 or +1 indicate a strong correlation (Cooper and Schindler, 2008).

component analysis as extraction method. Although the items could be divided into seven components, we found that 14 of them belonged to one component (the first component) with 0.43 as the lowest factor loading. If less acceptable cut-off levels of the factor loadings (0.30) were used, the component included 23 items (Garson, 2010b). This component alone explained 27.00% of the variance. The other 11 items were dispersed across six components with an explained variance which was significantly lower, while the items in these components appeared not to have any supporting theoretical background. Moreover, out of these components, eight items had cross-loadings with the first component which were higher than 0.40. According to Garson (2010b), factor loadings must always be interpreted in the light of theory, and not on the basis of arbitrary cut-off levels. Taking this principle into account, this result substantiates our claim that in this particular research study PACAP and RACAP have a strong relationship, which is why they have to be treated as a single variable (i.e., a firm's absorptive capacity). We therefore integrated the scores of PACAP and RACAP into an absorptive capacity index. The absorptive capacity score was calculated by averaging the scores of all 25 items used to measure both PACAP and RACAP.

The appropriateness of this approach was also supported by the interviews conducted during our field work, which indicates that although the respondents could give us fair estimates on the number of initiatives (PACAP) and innovations (RACAP) they had been involved in, in reality it was difficult for them to make a clear-cut separation between these two variables. This picture is in line with the situation applying to SMEs, where the initiatives and decisions with respect to the acquisition and utilization of new external knowledge are usually the responsibility of the owners of the firms (Stanworth and Curran, 1976; Tidd et al., 2005). Given this fact, we concluded that treating PACAP and RACAP separately as the indicators of absorptive capacity was not relevant in the SME context, especially in Indonesia.

A hierarchical regression analysis (Garson, 2010b) was performed to examine the effect of knowledge stickiness on firms' absorptive capacity in the first place, and the effect of interaction on their absorptive capacity in the second place. Knowledge stickiness has four indicators, while interaction has only one. The analysis has yielded two models. The first regression model (Model 1) consists of four indicators of stickiness as independent variables, and the second regression model (Model 2), includes interaction as another independent variable. To examine the effect of stickiness on absorptive capacity, the overall significant level of the first model was used, while the significant level of this variable in the second model served to check the effect of interaction.

7.6.2.1 Regression analysis: the main variables

As shown in Table 7.26, the research showed that stickiness of knowledge has a significant impact on the firm's absorptive capacity. In general, as can be seen in Model 1, the four indicators of stickiness significantly explain the firm's absorptive capacity ($F(4, 179)=14.93$, $p<0.01$). Among the four indicators, knowledge interconnectedness ($\beta=0.47$, $t=6.04$, $p<0.01$) and coded knowledge ($\beta=0.20$, $t=2.22$, $p<0.05$) were found to have a significant effect on the firm's absorptive capacity. Stickiness of external knowledge explains 23% of the total variance of the firm's absorptive capacity. This finding provides support to hypothesis H1 that states that *the lower the stickiness of external knowledge, the higher a firm's absorptive capacity*. In other words, the less sticky is the external knowledge, the higher the firm's absorptive capacity.

To test our hypothesis H2 that states that *the higher the intensity of the interaction, the higher a firm's absorptive capacity*, we included interaction as independent variable into the model (see Model 2 in Table 7.26). The result showed that interaction has a significant impact ($\beta=0.23$, $t=2.48$, $p<0.05$) on the firm's absorptive capacity. Adding interaction in the second regression model increases the explanation power of the model, from 23% to 26%. Based on this finding, we conclude that our hypothesis H2 is supported.

Table 7.26. Results of the regression analysis

Variable	*Model 1*		*Model 2*	
	β	*t*	*β*	*t*
Knowledge interconnectedness	0.47	6.04 ***	0.33	3.95 ***
Sensory knowledge	-0.07	-0.75	-0.04	-0.50
Coded knowledge	0.20	2.22 **	0.19	2.05 **
Theoretical knowledge	0.07	0.69	0.09	0.86
Interaction			0.21	2.48 **
F (4, 179); (5, 179)	14.93 ***		13.52 ***	
R^2	0.25		0.28	
Adjusted R^2	0.23		0.26	

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

Further, in the context of furniture firms, the research showed a similar finding. Knowledge stickiness is a significant predictor of the firm's absorptive capacity, and even can explains 36% of the total variance. Adding interaction variable into the regression model increases the explanation power of the model to 38%. In the case of software firms, only knowledge stickiness that has a significant impact on the firm's absorptive capacity with a lower explanation power (12%). For detailed information see Table B.9 and Table B.10 in Appendix B.

7.6.2.2 Regression analysis: the moderating variables

This subsection discusses the effects of a firm's age and size on the relationship between the independent variables (stickiness of knowledge and interaction) and the dependent variable. As stated in Section Table 7.27, the firms were grouped into two subcategories for each moderating variable, based on the mean of their scores. For the age variable, the firms were grouped into 0=younger and 1=older, and for the size variable into 0=smaller and 1=larger.

In examining the hypotheses on the effects of a firm's age and its size on the relationship between stickiness of knowledge and absorptive capacity, the values of adjusted R^2 that indicates an explanation power of the model were used. On the other hand, in examining the effects of a firm's age and its size on the relationship between interaction and absorptive capacity the β values of the relevant independent variables for each group (smaller and larger firms, and younger and older firms) were used as points of reference and compared to determine the strength of their impact (Garson, 2010b). The results of the regression analysis of the impact of a firm's age are summarized in Table 7.27.

Table 7.27. Results of the regression analysis using a firm's age as a moderating variable

Variable	*Model 1*		*Model 2*	
	β	*t*	β	*t*
Younger firms				
Knowledge interconnectedness	0.42	4.99 ***	0.30	2.79 ***
Sensory knowledge	0.02	0.14	0.04	0.37
Coded knowledge	-0.10	-0.75	-0.12	-0.91
Theoretical knowledge	0.26	1.94 *	0.27	2.01 **
Interaction			0.18	1.69 *
F (4, 179); (5, 179)	6.97 ***		6.24 ***	
R^2	0.19		0.21	
Adjusted R^2	0.17		0.18	
Older firms				
Knowledge interconnectedness	0.53	5.29 ***	0.34	2.73 ***
Sensory knowledge	-0.06	-0.43	-0.06	-0.41
Coded knowledge	0.46	3.86 ***	0.45	3.87 ***
Theoretical knowledge	-0.11	-0.69	-0.04	-0.28
Interaction			0.36	2.42 **
F (4, 179); (5, 179)	11.83 ***		11.42 ***	
R^2	0.45		0.50	
Adjusted R^2	0.41		0.46	

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

As indicated, in the case of the younger firms, knowledge stickiness ($F(4, 179)=6.97$, $p<0.01$) and interaction ($\beta=0.18$, $t=1.69$, $p<0.10$) are significant predictors of the organizations' absorptive capacity. Knowledge stickiness alone (see Model 1 for Table 7.27) explains 17% of the total variance. Together with

interaction, its explanation power increases to 18%. In the case of the older firms, knowledge stickiness also significantly explains their absorptive capacity ($F(4, 179)=11.83$, $p<0.01$) with and explanation power of 41%. Interaction also has a significant impact on the organizations' absorptive capacity ($\beta=0.36$; $t=2.42$, $p<0.05$). Furthermore, knowledge stickiness and interaction (see Model 2 for Table 7.27) explain 46% of the total variance of absorptive capacity, which is much higher compared to the model for the younger firms (18%). This findings indicates that stickiness and interaction are more important concepts for older than for younger firms.

The findings lead us to conclude that the effect of firm's age of the relationship between knowledge stickiness and absorptive capacity is stronger for the older firms (adjusted $R^2=41\%$) than for the younger ones (adjusted $R^2=17\%$). This means that our hypothesis H3a that states that *the relationship between the stickiness of external knowledge and absorptive capacity is stronger for older firms than for younger firms* is supported.

Similar findings were found for interaction. For the older firms, the β value of interaction ($\beta=0.36$, $t=2.42$) is significantly higher than that for the younger enterprises ($\beta=0.18$, $t=1.69$). These findings indicate that our hypothesis regarding interaction H4a that states that *the relationship between interaction and absorptive capacity is stronger for older firms than for younger firms* is confirmed.

As shown by Table 7.28, in the case of smaller firms, only knowledge stickiness ($F(4, 179)=11.02$, $p<0.01$) was found to have significant effect of the firm's absorptive capacity. Knowledge stickiness explains 22% of the total variance. For the larger firms, knowledge stickiness also significantly ($F(4, 179)=5.43$, $p<0.01$) explains the firm's absorptive capacity, even in a better explanation power (28%). Knowledge stickiness and interaction, which also have significant impact on the firm's absorptive capacity, explain 32% of the total variance of absorptive capacity.

We then may conclude that with respect to the size variable, the effect of a firm's size on the relationship between knowledge stickiness and absorptive capacity is stronger for the larger firms (adjusted $R^2=28\%$) than for the smaller ones (adjusted $R^2=22\%$). These findings are in line with our hypotheses regarding the effect of firm's size on the relationships between knowledge stickiness and absorptive capacity, and hence, the hypothesis H3b that states that *the relationship between the stickiness of external knowledge and absorptive capacity is stronger for larger firms than for smaller firms* is corroborated.

Table 7.28. Results of the regression analysis using a firm's size as a moderating variable

Variable	*Model 1*		*Model 2*	
	β	*t*	*β*	*t*
Smaller firms				
Knowledge interconnectedness	0.49	6.34 ***	0.39	3.84 ***
Sensory knowledge	-0.04	-0.41	-0.03	-0.28
Coded knowledge	0.13	1.27	0.12	1.12
Theoretical knowledge	0.10	0.84	0.12	0.97
Interaction			0.14	1.33
F (4, 179); (5, 179)	11.02 ***		9.22 ***	
R^2	0.25		0.26	
Adjusted R^2	0.22		0.23	
Larger firms				
Knowledge interconnectedness	0.44	3.53 ***	0.28	1.88 *
Sensory knowledge	-0.13	-0.81	-0.11	-0.68
Coded knowledge	0.50	2.52 **	0.50	2.61 **
Theoretical knowledge	-0.07	-0.36	-0.09	-0.46
Interaction			0.28	1.85 *
F (4, 179); (5, 179)	5.43 ***		12.83 ***	
R^2	0.34		0.39	
Adjusted R^2	0.28		0.32	

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

Further, for the larger firms, the β value of interaction ($\beta=0.28$, $t=1.85$) is significantly higher than that for the smaller enterprises in which interaction does significant impact on the firm's absorptive capacity. These findings indicate that our hypothesis regarding interaction H4b that states that *the relationship between interaction and absorptive capacity is stronger for larger firms than for smaller firms* is substantiated.

7.6.2.3 Absorptive capacity of the furniture and software sectors

Based on the level of education of the employees (see Alvesson, 2004; Starbuck, 1992), we have labeled the firms in the furniture sector as "less knowledge-intensive firms", and those in the software sector as "more knowledge-intensive firms". Furthermore, we hypothesized that the absorptive capacity of the software firms is higher than that of the furniture firms (hypothesis H5).

An *independent samples t-test* was used to compare the mean scores on absorptive capacity between the two sectors (see Table 7.29). The results show that the absorptive capacity of the software firms (mean=2.82, SD=0.63) is significantly higher ($t=-2.63$, $p<0.01$) than that of the furniture firms (mean=2.57, SD=0.92). This means that hypothesis H5 is supported.

Table 7.29. Absorptive capacity between the two sectors

Sectors	*Absorptive capacity*		t^a
	Mean	*SD*	
Furniture firms	2.57	0.92	-2.63***
Software firms	2.86	0.63	

Note: [a] For a mean comparison between the two sectors
*p<0.1, ** p<0.05, *** p<0.01

We established that only a handful of SMEs have their own R&D department and that the R&D departments of the older (r=0.34, p<0.05) and the larger (r=0.42, p<0.01) firms tend to be larger in terms of the number of employees. Our findings also show that a firm's R&D department has a significant impact on its absorptive capacity. After performing an *independent samples t-test*, we found that the absorptive capacity of firms that have an R&D department (mean=3.12, SD=0.64) is significantly (t=4.90, p<0.01) higher than of those without R&D facilities (mean=2.57, SD=0.80). We also observed that a firm's age and its size only play a minor role (r=0.14, p<0.05). These findings imply that the discussion about the effect of a firm's age and its size in the context of absorptive capacity is still relevant.

7.7 Conclusion

This chapter discussed the demographic aspects of a sample of Indonesian furniture and software firms and their owners. The vast majority of the owners have a university educational background. Most of them also have working experience in the private sector. The furniture firms are located in villages, suburban, and urban areas, while the software firms are mainly located in urban areas. In both sectors the firms mainly rely on the domestic market, although the market share of the furniture firms is significantly lower than that of the software firms. Personal savings form the main source of capital with respect to the establishment of the firms.

Two characteristics of knowledge (content/domains and types of knowledge) with respect to stickiness of knowledge have been discussed. We analyzed the content of knowledge in terms of knowledge interconnectedness as provided by three groups of knowledge sources (direct individual, direct institutional, and indirect). In the perception of the furniture firms, the direct individual sources provide the largest number of knowledge domains, while the software firms find that the indirect sources supply the richest variety of knowledge domains. Both sectors perceive the knowledge provided by indirect sources as information with the highest level of interconnectedness. Knowledge about products appears to be the most dominant domain provided by the external sources, especially by the direct individual and indirect knowledge suppliers.

We also discussed the types of knowledge absorbed by the furniture and software firms, the domains of knowledge provided by external parties, and the stickiness of knowledge.

Sensory knowledge is the most dominant knowledge type absorbed by the furniture firms, while in the case of software firms, it is coded knowledge. With respect to the issue of knowledge transfer, the direct individual sources are the furniture and software firms' main providers of sensory and theoretical knowledge. As regards the furniture firms, the coded knowledge is mostly provided by direct individual sources, while in the case of the software firms the indirect sources are the main suppliers of this type of knowledge.

The furniture firms perceive the external knowledge as more sensory, more theoretical, and more coded than the software firms do. With respect to these first two types of knowledge (sensory and theoretical), we conclude that the external knowledge is perceived as less sticky by the software firms than by the furniture firms. Further, the furniture firms perceive external knowledge as more coded, and therefore more accessible to absorb. In addition, in order to describe the three types of knowledge in terms of the degree of stickiness, a knowledge space was drawn.

Next, this chapter dealt with the interaction and absorptive capacity of the furniture and software firms. Both the furniture and the software firms interact the most intensively with direct institutional parties. In the interaction with external parties, traditional channels are used more frequently than non-traditional ones. However, the software firms use non-traditional channels more frequently than the furniture firms do. In the interaction with direct institutional parties formal meetings are the most common, while contacts with direct individual parties are usually made through informal channels.

Finally, we touched upon the firms' absorptive capacity in terms of initiatives and innovation. In the case of the software firms, product, process, and organizational innovation initiatives are quite common, while the furniture firms are more focused on realizing innovations without planning them in advance. With respect to innovation output, due to the fact that the firms in the two sectors are order-based manufacturing companies, they are mainly focused on product innovation. Not surprisingly, the owners of these firms are the most important actors in the stimulation of activities in this field. Only a few furniture and software firms have their own R&D department. Further, with respect to the development of innovative products, buyers and the Internet form the main sources of knowledge.

We also observed that the levels of newness or changes are dependent on the perception of the firms. To conclude, both the furniture and the software firms studied prefer incremental innovation projects to radical innovation trajectories.

In this chapter, we have also tested the empirical research hypotheses. Table 7.30 summarizes the results. Knowledge interconnectedness and coded knowledge were found to be the sufficient determinants of a firm's absorptive capacity, indicated by the organization's level of innovativeness. The findings of this study support previous research on the importance of external knowledge in the stimulation of the innovativeness of firms (Nonaka et al., 2000; Inkpen, 1998). In addition, interaction among firms plays an important role in enhancing firms' activities in the field of innovation.

From an empirical point of view, we conclude that using the potential and realized capacity as *separate* items has proven to be not relevant to explain the phenomenon of absorptive capacity in the context of SMEs at least in developing countries. The approach to combine the potential and realized capacity is clearly more suitable than the classic method of measuring absorptive capacity based on a firm's R&D expenditure (cf. Waalkens, 2006). The indicators of absorptive capacity we used, representing a firm's innovation initiatives and the innovations actually realized, respectively, have fully covered all innovation activities of the SMEs in our study (Kleinknecht, 1987).

Table 7.30. Summary of the regression analysis

No.	*Hypothesis*	*Finding*
H1	The lower the stickiness of external knowledge, the higher a firm's absorptive capacity.	Supported
H2	The higher the intensity of interaction, the higher a firm's absorptive capacity	Supported
H3a	The relationship between the stickiness of external knowledge and absorptive capacity is stronger for older firms than for younger firms	Supported
H3b	The relationship between the stickiness of external knowledge and absorptive capacity is stronger for larger firms than for smaller firms	Supported
H4a	The relationship between interaction and absorptive capacity is stronger for older firms than for younger firms	Supported
H4b	The relationship between interaction and absorptive capacity is stronger for larger firms than for smaller firms	Supported
H5	The absorptive capacity of software firms (as more knowledge-intensive firms) is higher than that of furniture firms (as less knowledge-intensive firms).	Supported

Further, the impacts of knowledge stickiness on a firm's absorptive capacity are stronger for older and larger organizations than for younger and smaller enterprises. The same holds for the interaction on a firm's absorptive capacity which appears to be stronger for older and larger companies than for younger and smaller ones. Moreover, also the various interaction channels play a role in the knowledge absorption of firms.

Finally, the more knowledge-intensive firms have scored higher on absorptive capacity than the less knowledge-intensive enterprises. This finding is in line with that of Burrone and Jaiya (2005), who claim that the innovative capability of SMEs varies significantly, depending on their sector, age, resources, and the business environment in which they operate. Our study has particularly pointed to the significance of sector, age, and size in explaining the absorptive capability phenomenon in developing countries.

The next chapter discusses and presents the conclusions of our study together with its limitations and implications for further research.

8. Discussion and Conclusions

8.1 Introduction

In this last chapter we will discuss the most significant results of our study and present our conclusions. In addition, we will address the contribution of this study, its limitations, and its implications for future research.

8.2 Discussion

The following subsections deal with the results of the hypotheses tests as described in the previous chapter. We will mainly concentrate on the two research questions discussed in Chapter 5: (a) W*hat is the effect of the stickiness of external knowledge on a firm's absorptive capacity?* and (b) W*hat is the influence of interaction on a firm's absorptive capacity?*

8.2.1 The effect of the stickiness of external knowledge on a firm's absorptive capacity

We established that knowledge stickiness has a significant impact on a firm's absorptive capacity, in the expected direction. The lower the level of stickiness of a piece of external knowledge as perceived by the (furniture and software) SMEs in our sample, the higher the absorptive capacity (initiatives and innovations) of these organizations. More specifically, we found that of the four indicators, only knowledge interconnectedness and coded knowledge have a significant effect on the companies' absorptive capacity. Although in general the level of interconnectedness of the knowledge absorbed by the firms is low (see Chapter 7), it still has an important impact on the ability of organizations to focus on innovation.

The findings of our study also confirmed that coded knowledge has a significant relationship with the furniture and the software firms' activities in the field of innovation. In their capacity as order-based manufacturers, the buyers associated with these enterprises generally provide detailed information about

the products demanded. The more coded this knowledge, the easier it is for the firms to utilize this information in the development of their innovation projects. In this respect the availability of coded knowledge is highly crucial, especially in view of the buyers' product demands which have to be met (Hendry, 1998; Gereffi, 1999; Van Geenhuizen and Indarti, 2008).

As indicated by Asheim et al. (2007), knowledge inputs and outputs are generally represented in a coded form. The codification of knowledge is common for several reasons: 1) knowledge inputs are often based on reviews of existing studies in the coded form, 2) knowledge generation is based on the application of scientific principles and methods, 3) knowledge processes are usually quite formally organized, and 4) outcomes are often documented in reports, electronic files, or patent descriptions, also in the coded form (Asheim et al., 2007:661).

Our findings confirmed that the effect of knowledge stickiness on absorptive capacity is stronger for older and larger firms than for younger and smaller firms. The more capable a firm is to grasp external knowledge, the better it is able to utilize this information in the development of innovative products. Older and larger firms are more able to absorb knowledge. In this respect, the older and the larger companies have the advantage that they are more experienced in integrating the newly absorbed information into their internal know-how. Since the internal knowledge possessed by the older and the larger firms is more extensive in terms of depth and domains, it is easier for these organizations to interpret the newly absorbed external information and achieve more advanced innovative results (Avermaete et al., 2003; Sørensen and Stuart, 2000). The scope of the younger and smaller companies' knowledge resources - and thereby their capacity to combine and interpret new information - are still rather limited. As a result, their innovative output will tend to be less elaborated. As indicated by Daghfous (2004), larger firms with sufficient R&D resources are likely to be more innovative than smaller firms, which in most cases have only limited R&D facilities at their disposal.

Next, our study indicated that the absorptive capacity of the software firms, as the representatives of more-knowledge intensive organizations, is higher than that of the furniture firms. This finding shows that existing knowledge which is embedded in the mind of the knowledge carrier (i.e., owner/employee) has a positive relationship with the organization's absorptive capacity. This evidence supports the claims made by Nelson and Winter (1982) and Davenport and Prusak (1998) regarding this issue. As discussed in Chapter 7, the level of education of both the owners and the employees of the furniture firms is lower than that of the staff members of the software firms. Evidentially, employees

with a higher educational background possess more knowledge than those with a lower education (see Alvesson, 2004; Starbuck, 1992; Robertson and Swan, 1998). We found that a high level of expertise on the part of the employees in terms of the amount of knowledge they possess has a positive effect on a firm's capability to absorb external knowledge. We may conclude that this study substantiates the findings of previous studies conducted by Cohen and Levinthal (1990), Vinding (2000), and Schmidt (2005), which indicate that an organization's absorptive capacity is dependent on the absorptive capacity of its individual members.

8.2.2 The influence of interaction on a firm's absorptive capacity

Our second research question concerned the relationship between interaction and absorptive capacity. The results demonstrated that the interaction between the furniture/software firms studied and their environments plays an important role in these organization's innovation activities. The more frequently they interact with the external environment, the more intensive their activities in the field of innovation.

In addition, we found that both the furniture and the software firms interact more frequently with direct individual parties, such as buyers, than with direct institutional parties, such as religious affiliations. With respect to the interaction with indirect sources, we established that all companies in our sample intensively access the Internet. This finding is in line with that of previous studies (e.g., Nonaka, 1994; Nonaka and Takeuchi, 1995; Tsai and Goshal, 1998), which indicates that a firm's interaction with its environment has a significant impact on its innovation policies.

Next, we observed that the strength of the impact of interaction on a firms' absorptive capacity differs between older and younger organizations. Interaction is an accumulation of time and experience. This is why younger firms perceive it as more difficult to establish and maintain strong relationships with their environment. In this context we may conclude that an increase in the intensity of interaction with external parties has a more substantial impact on the absorptive capacity of older firms than on that of younger companies. In general, older firms have had more time to invest in and maintain large networks with external parties. This means that even a small increase in the intensity of their interaction with these parties will yield a substantial impact, because their network consists of so many external links.

As regards the channels of interaction, we found that traditional channels, such as face-to-face meetings, are more commonly used than non-traditional channels, such as the facsimile, telephone, and e-mail (see Section 7.4.2 in

Chapter 7). The non-traditional channels are, however, more frequently used by the software firms than by the furniture companies.

In addition, interaction with direct individual knowledge sources takes more frequently place in an informal way, whereas the communication with direct institutional sources is generally more formal. However, it appeared that regardless of the channels, the more intensive the interaction with external parties, the more external knowledge a firm can absorb, and the higher its absorptive capacity. The results suggest that companies should use each opportunity to interact with external parties, which can basically all be considered as potential knowledge providers.

8.3 Contributions of the Study

Considering the results of this research, several contributions can be listed. Firstly, the current study has increased our understanding of the absorptive capacity concept in the specific context of SMEs in a developing country, a research setting which has only received little attention so far. Measurements based on R&D spending or the numbers of patents, which are commonly used to analyze large companies in developed countries (see Cohen and Levinthal, 1989; Daghfous, 2004), are not suitable for studying emerging economies in developing countries, such as Indonesia. Our research confirmed that only a handful of SMEs adopt systematic approaches to realizing their innovations. The role of the owner as the initiator and supervisor of innovation policies was found to be very substantial. This is why the number of initiatives and innovations actually realized by the firms proved to be a suitable alternative to the measurement of absorptive capacity in this context. In this way, this study has partly filled the gap in the literature on absorptive capacity as identified by Liao et al. (2003), which especially refers to the lack of attempts to measure the concept in a different way than by means of the R&D context.

Secondly, we initially adopted two indicators of absorptive capacity, namely initiatives representing the potential absorptive capacity, and the actual innovations indicating the realized absorptive capacity (Zahra and George, 2002; Waalkens, 2006). However, our findings showed that these two separate indicators might particularly be relevant in the context of SMEs in developed countries (Waalkens, 2006), but appear to be less suitable for the analysis of emerging economies, such as those in Indonesia. Hence, we concluded that the decision of whether or not to use these indicators should depend on the kind of products, the branch and the empirical setting. Both are relevant, but often only one or a combination will be sufficient.

Thirdly, another contribution of this study is the finding that the division of knowledge into three types, namely sensory, coded, and theoretical information is not mutually exclusive. A piece of knowledge provided by a particular source may be a combination of the three types mentioned above. In addition, knowledge that is theoretically characterized as coded, may for several reasons by a firm be considered as sensory, for example as a result of the level of its internal expertise. To conclude, our research has shown that the way in which knowledge is perceived and characterized depends on both the recipient organization and its specific context.

Although the research setting of this study consisted of SMEs in an emerging economy in a developing country, namely Indonesia, our findings can well be generalized to similar contexts, given the fact that in general more or less the same conditions apply to SMEs, especially to those in emerging economies.

8.4 Implications of the Study

In a practical sense, this study suggests that SMEs which are willing to improve their activities in the field of innovation should intensify their interactions with external sources (such as buyers and the Internet), because these information providers offer a larger spectrum of knowledge domains. Parties interested in supporting SMEs, such as government agencies and universities/research centers, which however played a marginal role in this study, should pay more attention to facilitating these SMEs in improving their ability to access knowledge, in terms of knowledge transparency and in organizational structures. In the case of the software firms, the lack of financial means appeared to be the main barrier to obtaining access to knowledge, while for the furniture firms a lack of foreign language skills was the most important reason why they were unsuccessful in approaching the various knowledge sources. Firms should use every single opportunity they get to absorb as much knowledge as possible from external parties. They should collect this information in formal as well as informal ways, for example through face-to-face meetings and/or with the help of communication technology.

Another approach to improving a firm's capability of absorbing and utilizing external knowledge would be to attract better-qualified personnel. We have to add, however, that well-educated staff members are no guarantee for successful innovations. However, appointing highly skilled employees would in any case provide a solid basis for the initiation of innovation activities. Other important assets in promoting innovation are a good working climate and mentality within the firm and an experienced staff. If firms cannot employ well-educated people, for example due to limited financial means, which prevents them from offering their staff a reasonable salary, it would be a wise alternative to call upon the

industry association to offer support in obtaining a skilled workforce. Another option would be to offer the owners/managers of SMEs an intensive training in innovative thinking. Training may increase the firms' possibilities with respect to the realization of innovation projects in various areas.

8.5 Limitations and Suggestions for Future Research

Like any other empirical study, this research is not without its limitations. The first limitation is that in this study, the measurement of absorptive capacity was solely based on the subjective perception of the owner/manager. Although this approach was the most suitable one in the context of our research (furniture and software SMEs in Indonesia), it may have led to bias, the more so because these organizations often have no complete record of the number of innovations realized. If the data available could be made more objective, their measurement will – in turn – yield more objective results.

Second, organizational absorptive capacity is a dynamic construct which includes the entire process of organizational learning within a firm. In our study we reduced the scope of absorptive capacity to a certain point in time (the time during which the empirical research was conducted and related to initiatives and innovations). As a result, we were not able to capture all the other stages of the learning process. Therefore, future research may focus on the whole trajectory, which starts with the retrieval of knowledge and ends with the realization of innovative output.

Third, during our field study we observed that the firms had difficulty in providing reliable information regarding the contribution of innovation to their turnover. This is why the relationship between a firm's absorptive capacity (i.e., innovation) and its turnover could not be examined. Including an analysis of this relationship in future research would provide more insight into the contribution levels of the three types of innovation (product, process and organizational) in terms of turnover. Moreover, on the basis of this information it would be possible to obtain concrete figures on the actual profitability of innovation projects.

Fourth, knowledge stickiness was approached from the perspective of the cognitive and physical accessibility of external knowledge, while we did not pay any attention to its financial accessibility. The integration of the financial aspect into our analysis has appeared to be important since the firms in our sample considered their lack of financial means as the severest obstacle to the absorption of knowledge from the external environment. Including financial accessibility would have enabled us to examine the costliness of obtaining information from external knowledge sources. The results of this analysis could

have then been used to formulate more suitable policies aimed at counteracting the financial obstacles to absorbing external knowledge.

8.6 Concluding Remarks

The discussion of the use of external knowledge from various knowledge sources by furniture and software firms was central in this thesis. By taking furniture and software firms in Indonesia as an emerging economy as points of reference, we found that SMEs nowadays are in more volatile situation due to an ever-changing business environment. To cope with such a situation, the SMEs have no choices other than doing innovation to sustain their existence in a tighter competition and to achieve operational excellences. Actual innovation conducted within the SMEs is relatively modest, and most the SMEs put emphasis on incremental innovations rather than radical ones. The SMEs paid substantial attention to product innovation that promptly leads to direct financial benefits and was less risky, while less attention was paid to process and organizational innovation. External knowledge obtained through intensive interaction with various external parties has an impact in stimulating innovation with the SMEs.

Although the firms in this study represent two sectors that are completely different, despite of differences in some aspects (e.g., export market share, educational level of the employees), the firms also shared some common characteristics relating to innovation. Most of them had no well-planned activities toward innovation. Often, initiatives leading to innovations were impulsively performed without any preceding formal planning, in addition to the fact that only a few firms had a specific R&D department responsible for innovation. Due to this context, separating initiatives (i.e., potential absorptive capacity) from innovations (i.e., realized absorptive capacity) is not a prudent choice. This separation is not based on the size of the firms or the context in emerging economy, but the poor planning processes in firms.

Taking this issue into account, the results of the study may be applicable to firms that are lacking a proper planning towards innovation. On the other hand, even in the SMEs context in developing countries, when the planning stage is properly carried out (such as in construction sectors), separating potential and realized absorptive capacity is a relevant option (cf. Waalkens, 2006).

The findings from this study might be used a basis for setting up appropriate initiatives and policies to promote the SMEs, especially in the context of emerging economies. For instance, government offices and industry associations as policy makers, can play their role more intensively in providing facilitation for the SMEs, including opening access to information on new products preferred

by markets, providing information on new potential markets, information on the availability of raw material in order to ensure its sustainability – especially wood yielded from government-managed forests, in the context of the furniture sector. In addition, significant attention should also be paid to activities in advancing capabilities for SMEs to access knowledge in other language and through the Internet, which is still under-utilized.

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Summary

The Effect of Knowledge Stickiness and Interaction on Absorptive Capacity: Evidence from Furniture and Software Small- and Medium-sized Enterprises in Indonesia

The capability of an organization to absorb knowledge from the external business environment and to use it in the development of innovations, referred to as absorptive capacity, has become a principal issue in organizational studies. Following Waalkens (2006), we have applied innovation as the indicator of a firm's absorptive capacity. This capability primarily concerns the skill of an organization to obtain (new) knowledge and use it in stimulating its innovation activities as an active response to a constantly changing market. The vast majority of studies on absorptive capacity are specifically focused on absorptive capacity in the context of large companies in developed countries. Only few have been conducted in the setting of small- and medium sized enterprises (SMEs) in a developing country. This is why we have chosen this particular context for our research, which deals with the absorptive capacity (i.e. concept and measurement) of SMEs in Indonesia, a developing country.

A firm's absorptive capacity is determined by the way in which the organization processes (new) knowledge from the external environment. From the perspective of the resource-based and the knowledge-based theories, knowledge can be considered as a strategic resource for strengthening a firm's competitiveness. (External) knowledge has several characteristics. From the receiver organization's point of view, these characteristics may influence the capability to absorb and utilize this knowledge in its innovation policies. The degree to which it is easy or difficult for an organization to absorb information from the external environment is referred to as the stickiness of external knowledge. The stickiness of external knowledge in terms of its interconnectedness between domains (i.e. product, process, organizational) and

its types (i.e. sensory, coded, and theoretical knowledge) affects a firm's capability to absorb this information and utilize it to conduct product, process, and/or organizational innovations. In this study, stickiness is viewed from the perspective of the receiver. The definition of the stickiness of knowledge is based on the degree of its accessibility, referring to the various levels of ease or difficulty with which information can be obtained and understood, both cognitively and physically.

Further, a firm's absorptive capacity is crucially dependent on its interaction with external knowledge providers. Interaction is a prerequisite for obtaining relevant knowledge from external parties in the business environment. The knowledge providers as the external participants in this interaction can be classified into three groups: direct individual sources (i.e. buyers, suppliers, competitors, and consultants); direct institutional sources (i.e. government offices, industry associations, religious affiliations, and research institutions/universities); and indirect sources (i.e. exhibitions, magazines, television, radio, and the Internet). The interaction between an organization and its environment takes place through various communication channels, such as face-to-face meetings, telephone, facsimile, and email.

Our main research questions are as follows:
1. What is the effect of stickiness of external knowledge on a firm's absorptive capacity?
2. What is the influence of interaction on a firm's absorptive capacity?

For our study we conducted an extensive survey among 198 SMEs (i.e., 98 furniture firms and 100 software firms) scattered in various cities in Indonesia (i.e., Yogyakarta, Bandung, Malang, and Surabaya). In this study, the furniture sector represents the less knowledge-intensive companies and the software sector the more knowledge-intensive firms. The data were collected from October 2007 until March 2008 by means of personal face-to-face interviews with the firms' owners or other (top) managers. We performed a hierarchical regression analysis to answer the research questions.

The current study showed that knowledge stickiness has a significant impact on a firm's absorptive capacity. The lower the level of stickiness of a piece of external knowledge as perceived by the (furniture and software) SMEs in our sample, the higher the absorptive capacity of these organizations. More specifically, we found that of the four indicators, only knowledge interconnectedness and coded knowledge have a significant effect on the companies' absorptive capacity. The more interconnected the external knowledge, the higher their absorptive capacity. Likewise, the more coded the

knowledge, the more accessible it is to firms for the purpose of creating innovative products.

Another finding indicates that the interaction between the furniture/software firms and their environments has a significant effect on their absorptive capacity. Further, the more frequent the interaction of firms with the external environment, the higher their absorptive capacity. The model used accounts for 26% of total the absorptive capacity variance. The study also indicates that the effect of knowledge stickiness on firms' absorptive capacity is stronger for older and larger companies than for younger and smaller ones. Likewise, the effect of interaction on a firm's absorptive capacity is stronger for older and larger organizations than for younger and smaller enterprises.

The research confirms that the level of absorptive capacity of the software firms, which represent the more knowledge-intensive organizations, is significantly higher than that of the furniture firms, as the representatives of the less knowledge-intensive companies.

Considering the results of this research, several contributions can be listed. *Firstly*, the current study has increased our understanding of the absorptive capacity concept in the specific context of SMEs in a developing country, a research setting which has only received little attention so far. Measurements based on R&D spending or the numbers of patents, which are commonly used to analyze large companies in developed countries (see Cohen and Levinthal,1989; Daghfous, 2004), are not suitable for studying emerging economies in developing countries, such as Indonesia. Our research confirmed that only a handful of SMEs adopt systematic approaches to realizing their innovations. The role of the owner as the initiator and supervisor of innovation policies was found to be very substantial. This is why the number of initiatives and innovations actually realized by the firms proved to be a suitable alternative to the measurement of absorptive capacity in this context. In this way, this study has partly filled the gap in the literature on absorptive capacity as identified by Liao et al. (2003), which especially refers to the lack of attempts to measure the concept in a different way than by means of the R&D context.

Secondly, we initially adopted two indicators of absorptive capacity, namely initiatives representing the potential absorptive capacity, and the actual innovations indicating the realized absorptive capacity (Zahra and George, 2002; Waalkens, 2006). However, our findings showed that these two separate indicators might particularly be relevant in the context of SMEs in developed countries (Waalkens, 2006), but appear to be less suitable for the analysis of emerging economies, such as those in Indonesia. Hence, we concluded that the decision of whether or not to use these indicators should depend on the kind of

products, the branch and the empirical setting. Both are relevant, but often only one or a combination will be sufficient.

Thirdly, another contribution of this study is the finding that the division of knowledge into three types, namely sensory, coded, and theoretical information is not mutually exclusive. A piece of knowledge provided by a particular source may be a combination of the three types mentioned above. In addition, knowledge that is theoretically characterized as coded, may for several reasons by a firm be considered as sensory, for example as a result of the level of its internal expertise. To conclude, our research has shown that the way in which knowledge is perceived and characterized depends on both the recipient organization and its specific context. Although the research setting of this study consisted of SMEs in an emerging economy in a developing country, namely Indonesia, our findings can well be generalized to similar contexts, given the fact that in general more or less the same conditions apply to SMEs, especially to those in emerging economies.

Like any other empirical study, this research is not without its limitations. The *first* limitation is that in this study, the measurement of absorptive capacity was solely based on the subjective perception of the owner/manager. Although this approach was the most suitable one in the context of our research (furniture and software SMEs in Indonesia), it may have led to bias, the more so because these organizations often have no complete record of the number of innovations realized. If the data available could be made more objective, their measurement will – in turn – yield more objective results.

Second, organizational absorptive capacity is a dynamic construct which includes the entire process of organizational learning within a firm. In our study we reduced the scope of absorptive capacity to a certain point in time (the time during which the empirical research was conducted and related to initiatives and innovations). As a result, we were not able to capture all the other stages of the learning process. Therefore, future research may focus on the whole trajectory, which starts with the retrieval of knowledge and ends with the realization of innovative output.

Third, during our field study we observed that the firms had difficulty in providing reliable information regarding the contribution of innovation to their turnover. This is why the relationship between a firm's absorptive capacity (i.e., innovation) and its turnover could not be examined. Including an analysis of this relationship in future research would provide more insight into the contribution levels of the three types of innovation (product, process and organizational) in terms of turnover. Moreover, on the basis of this information it would be possible to obtain concrete figures on the actual profitability of

innovation projects.

Fourth, knowledge stickiness was approached from the perspective of the cognitive and physical accessibility of external knowledge, while we did not pay any attention to its financial accessibility. The integration of the financial aspect into our analysis has appeared to be important since the firms in our sample considered their lack of financial means as the severest obstacle to the absorption of knowledge from the external environment. Including financial accessibility would have enabled us to examine the costliness of obtaining information from external knowledge sources. The results of this analysis could have then been used to formulate more suitable policies aimed at counteracting the financial obstacles to absorbing external knowledge.

By taking furniture and software firms in Indonesia as an emerging economy as points of reference, we found that SMEs nowadays are in more volatile situation due to an everchanging business environment. To cope with such a situation, the SMEs have no choices other than doing innovation to sustain their existence in a tighter competition and to achieve operational excellences. Actual innovation conducted within the SMEs is relatively modest, and most the SMEs put emphasis on incremental innovations rather than radical ones. The SMEs paid substantial attention to product innovation that promptly leads to direct financial benefits and was less risky, while less attention was paid to process and organizational innovation. External knowledge obtained through intensive interaction with various external parties has an impact in stimulating innovation with the SMEs.

Although the firms in this study represent two sectors that are completely different, despite of differences in some aspects (e.g., export market share, educational level of the employees), the firms also shared some common characteristics relating to innovation. Most of them had no well-planned activities toward innovation. Often, initiatives leading to innovations were impulsively performed without any preceding formal planning, in addition to the fact that only a few firms had a specific R&D department responsible for innovation. Due to this context, separating initiatives (i.e., potential absorptive capacity) from innovations (i.e., realized absorptive capacity) is not a prudent choice. This separation is not based on the size of the firms or the context in emerging economy, but the poor planning processes in firms. Taking this issue into account, the results of the study may be applicable to every firm that is lacking a proper planning towards innovation. On the other hand, even in the SMEs context in developing countries, when the planning stage is properly carried out (such as in construction sectors), separating potential and realized absorptive capacity is a relevant option (cf. Waalkens, 2006).

The findings from this study might be used a basis for setting up appropriate initiatives and policies to promote the SMEs, especially in the context of emerging economies. For instance, government offices and industry associations as policy makers, can play their role more intensively in providing facilitation for the SMEs, including opening access to information on new products preferred by markets, providing information on new potential markets, information on the availability of raw material in order to ensure its sustainability – especially wood yielded from government-managed forests, in the context of the furniture sector. In addition, significant attention should also be paid to activities in advancing capabilities for SMEs to access knowledge in other language and through the Internet, which is still under-utilized.

Samenvatting

Het effect van het hechtvermogen van kennis en interactie op het absorptie vermogen: Bewijs van kleine en grote meubel- en softwarebedrijven in Indonesië

Het vermogen van een organisatie tot het absorberen van kennis van de externe zakelijke omgeving en het gebruiken daarvan in de ontwikkeling van innovaties, ook wel absorptievermogen genoemd, is een voorname kwestie geworden in organisatorische studies. Tijdens het volgen van Waalkens (2006) hebben we innovatie gebruikt als een indicator voor het absorptievermogen van een bedrijf. Dit vermogen betreft in eerste instantie de vaardigheid van een organisatie om (nieuwe) kennis te verkrijgen en deze kennis te gebruiken om haar innovatieve activiteiten te stimuleren als een actieve reactie op een constant veranderende markt.

De meeste van de studies over het absorptievermogen zijn specifiek gericht op het absorptievermogen in de context van grote bedrijven in ontwikkelde landen. Slechts enkele zijn uitgevoerd in de setting van midden klein bedrijf (MKB) in een ontwikkelingsland. Dit is de reden dat wij deze specifieke context hebben gekozen voor ons onderzoek, dat het absorptievermogen (met ander woorden concept and meetbaarheid) van MKB's in Indonesië, een ontwikkelingsland, behandeld.

Het absorptievermogen van een firma wordt vastgesteld door de manier waarop het bedrijf (nieuwe) kennis uit de externe omgeving verwerkt. Vanuit het oogpunt van brongerelateerde en kennisgebaseerde theorieën kan kennis worden gezien als een strategische bron om de concurrentiepositie van een bedrijf te versterken. (Extern) kennis heeft verschillende eigenschappen. Vanuit het oogpunt van de ontvangende organisatie kunnen deze eigenschappen het vermogen om kennis te absorberen en te gebruiken in innovaties beïnvloeden.

De mate waarin het gemakkelijk of moeilijk is voor een organisatie om informatie vanuit de externe omgeving te absorberen wordt ook wel verwezen naar als hechtvermogen of externe kennis. Het hechtvermogen van externe kennis wat betreft de samenhang tussen domeinen (in andere woorden product, proces, organisatorisch) en types (in andere woorden sensorische, gecodeerde en theoretische kennis) heeft invloed op het vermogen van de firma om deze informatie te absorberen en het te gebruiken om producten, processen en/of organisatorische innovaties te geleiden. In deze studie nemen we een kijkje naar hechtvermogen vanuit het oogpunt van de ontvanger. De definitie van het hechtvermogen van kennis is gebaseerd op de mate van toegankelijkheid, refererend naar de diverse maten van gemakkelijkheid of moeilijkheid waarin informatie kan worden verkregen en begrepen, zowel cognitief als fysiek.

Verder hangt het absorptievermogen van een bedrijf cruciaal af van de interactie van de bedrijf met zijn externe kennisleveranciers. Interactie is een eerste vereiste voor het verkrijgen van relevante kennis van externe partijen in de zakenwereld. De kennisverstrekkers als de externe deelnemers in deze interactie kunnen worden onderverdeeld in drie groepen: directe individuele bronnen (met andere woorden: kopers, leveranciers, concurrenten en adviseurs); directe institutionele bronnen (rijksbetrekkingen, industrie associaties, geloofsaffiliaties en onderzoeksinstituten/universiteiten); en indirecte bronnen (tentoonstellingen, tijdschriften, televisie, radio en het internet). De interactie tussen een organisatie en haar omgeving vind plaats door diverse communicatiekanalen zoals face to face gesprekken, telefoon, facsimile en email.

Onze belangrijkste onderzoeksvragen zijn als volgt:
1. Wat is het effect van hechtvermogen van externe kennis op het absorptie vermogen van een firma?
2. Wat is de invloed van interactie op het absorptie vermogen van een bedrijf?

Voor ons onderzoek hebben we een uitgebreide enquête gehouden onder 198 MKB's (98 meubelbedrijf's en 100 softwarebedrijf's) verspreid over verschillende steden in Indonesië (Yogyakarta, Bandung, Malang en Surabaya). In dit onderzoek representeert de meubelsector the mindere kennisintensieve bedrijven en de software sector de meer kennisintensieve bedrijven. De informatie was verzameld van oktober 2007 tot maart 2008 door middel van persoonlijke een op een interviews met de eigenaren of andere (top) managers van de firma's. We hebben een hiërarchische regressie analyse uitgevoerd om de onderzoeksvragen te beantwoorden.

Het huidige onderzoek liet zien dat het hechtvermogen van kennis een significante impact heeft op het absorptievermogen van een firma. Hoe lager de mate van hechtvermogen van een stukje externe informatie zoals waargenomen in de (meubel en software) MKB's in ons voorbeeld, hoe hoger het absorptievermogen van deze organisaties. Meer specifiek gezegd; wij hebben bevonden dat van de vier indicators, alleen kennis samenhang en gecodeerde kennis een significant effect hebben op het absorptie vermogen van het bedrijf. Hoe meer samenhangend de externe kennis is, hoe hoger het absorptievermogen is. Evenzo, hoe meer gecodeerd de kennis is, hoe toegankelijker het is voor de firma om te gebruiken bij het creëren van innovatieve producten.

Een andere bevinding toont aan dat de interactie tussen de meubel/software firma's en hun omgeving een significant effect heeft op hun absorptie vermogen. Verder, hoe frequenter de interactie van de firma's met hun externe omgeving, hoe hoger hun absorptievermogen is. Het model gebruikte accounts voor 26% van het totale absorptievermogen. Het onderzoek toont ook aan dat het effect van kennis hechtvermogen op het absorptie vermogen van een bedrijf sterker is bij oudere en grotere bedrijven dan bij jongere, kleinere bedrijven. Evenzo, het effect van interactie op het absorptie vermogen van een bedrijf is sterker bij oudere en grotere organisaties dan bij jongere en kleinere ondernemingen.

Het onderzoek bevestigd dat de mate van absorptievermogen van de software bedrijven, welke de meer kennisintensieve organisaties representeren, significant hoger is dan dat van de meubelfirma's, als zijnde de vertegenwoordigers van de minder kennisintensieve bedrijven.

Gezien de resultaten van dit onderzoek kunnen we verschillende contributies noteren. Ten eerste, heeft het huidige onderzoek ons begrip van het concept absorptievermogen in de specifieke context van MKB's in een ontwikkelingsland verhoogd, een onderzoekssetting dat tot nu toe nog maar weinig aandacht heeft gekregen. Metingen gebaseerd op O&O uitgaven of het aantal patenten die meestal gebruikt worden om grote bedrijven in ontwikkelingslanden te analyseren (zie Cohen en Levinthal, 1989; Daghfous, 2004) zijn niet geschikt voor het bestuderen van de opkomende economie in ontwikkelingslanden als Indonesië. Ons onderzoek heeft bevestigd dat maar een handvol MKB's systematische benaderingen toepassen om hun innovaties te realiseren. De rol van de eigenaar als de opdrachtgever en supervisor van het innovatiebeleid bleek erg belangrijk te zijn. Dit is de reden dat het aantal initiatieven en innovaties die gerealiseerd zijn door de bedrijf's een geschikt alternatief bleken te zijn voor het afmeten van het absorptievermogen in deze context. Op deze manier heeft dit onderzoek het gat in de literatuur weten te

dichten, aangaande absorptie vermogen, zoals aangetoond door Liao et al (2003), welke specifiek refereren naar het gebrek aan pogingen om het concept op een andere manier te meten dan door middel van de O&O context.

Ten tweede, in eerste instantie hebben we twee indicators van absorptievermogen toegepast, zijnde initiatieven die het potentiële absorptievermogen representeren en de eigenlijke innovaties die het gerealiseerde absorptievermogen aangeven (Zahra and George, 2002; Waalkens, 2006). Echter, onze bevindingen lieten zien dat deze twee aparte indicatoren bijzonder relevant kunnen zijn in de context van MKB's in ontwikkelingslanden (Waalkens, 2006), maar lijken minder geschikt voor de analyse van opkomende economie zoals in Indonesië. Aldus hebben wij geconcludeerd dat de beslissing om wel of niet gebruik te maken van deze indicators zou moeten afhangen van het type product, het merk en de empirische setting. Beiden zijn relevant, maar meestal zal alleen een combinatie of maar een ervan genoeg zijn.

Ten derde, een andere bijdrage van dit onderzoek is de bevinding dat de verdeling van kennis in drie types, zijnde sensorische, gecodeerde en theoretische informatie, niet onderling exclusief is. Een deel informatie, geleverd door een specifieke bron kan een combinatie zijn van de drie types die hierboven genoemd zijn. Ter aanvulling, kennis die in theorie gekarakteriseerd is als gecodeerd kan om verschillende redenen door een bedrijf worden gezien als sensorisch, bijvoorbeeld als een resultaat van de mate van haar interne expertise. In conclusie, ons onderzoek heeft aangetoond dat de manier waarop kennis geïnterpreteerd en gekarakteriseerd wordt afhangt van zowel de ontvangende organisatie als de specifieke context van de kennis.

Hoewel de onderzoekssetting van deze studie bestond uit MKB's in een opkomende economie in een ontwikkelingsland, namelijk in Indonesië, kunnen onze bevinden zeker gegeneraliseerd worden tot soortgelijke contexten door het gegeven dat in feite min of meer dezelfde condities opgaan voor MKB's, zeker voor die in opkomende economieën.

Zoals iedere andere empirische studie, is dit onderzoek niet zonder beperkingen. De eerste beperking is dat in deze studie, de meetbaarheid van het absorptievermogen alleen gebaseerd was op de subjectieve perceptie van de eigenaar/manager. Hoewel deze aanpak de meest geschikte was in de context van ons onderzoek (meubel- en software MKB's in Indonesië) kan het hebben geleid tot bevooroordeeldheid, meer nog omdat deze organisaties meestal geen compleet register hebben van het aantal gerealiseerde innovaties. Als de beschikbare informatie meer objectief gemaakt zou kunnen worden, zou hun meetbaarheid, in turn, meer objectieve resultaten laten opbrengen.

Ten tweede, organisatorisch absorptievermogen is een dynamische constructie die het gehele proces van organisatorisch leren binnenin een firma omvat. In ons onderzoek hebben we het bereik van het absorptievermogen verlaagd tot een bepaald moment (het moment waarop het empirisch onderzoek werd gehouden en in relatie tot initiatieven en innovaties). Als resultaat waren wij niet in staat al de andere fases van het leerproces te grijpen. Daarom zouden studies in de toekomst zich kunnen richten op het gehele traject, dat start met het vinden van kennis en eindigt met het realiseren van innovatieve bedrijfsopbrengst.

Ten derde, gedurende ons veldonderzoek observeerden we dat de firma's moeite hadden met het aanbieden van betrouwbare informatie omtrent de bijdrage van innovatie aan hun winst. Dit is de reden dat de relatie tussen het absorptievermogen van een firma (innovatie) en de winst van de firma niet bestudeerd konden worden. Het toevoegen van een analyse van deze relatie in toekomstige onderzoeken zou meer inzicht geven in de toegevoegde waarde van de innovatietypes (product, proces en organisatorisch) in termen van winst. Bovendien zou het op basis van deze informatie mogelijk zijn om concrete cijfers te verkrijgen van de eigenlijke winstgevendheid van innovatieve projecten.

Ten vierde, kennis hechtvermogen was benaderd vanuit het perspectief van de cognitieve en fysische toegankelijkheid van extreme kennis, terwijl we geen aandacht hebben besteed aan de financiële toegankelijkheid. De integratie van het financiële aspect in onze analyse is belangrijk gebleken daar de firma's in ons voorbeeld hun gebrek aan financiële middelen als het grootste obstakel voor het absorberen van kennis uit hun externe omgeving beschouwen. Het toevoegen van financiële toegankelijkheid zou het voor ons mogelijk hebben gemaakt om de kosten voor het verkrijgen van informatie van externe kennisbronnen te onderzoeken. De resultaten van deze analyse zouden dan gebruikt kunnen worden om een meer passend beleid te formuleren gericht op tegenacties tegen de financiële obstakels voor het absorberen van externe kennis.

Door meubel en software firma's in Indonesië als een opkomende economie als referentiepunt te nemen kwamen wij erachter dat MKB's in deze tijd in een meer vergankelijke situatie zitten door een constant veranderende zakelijke omgeving. Om te kunnen omgaan met een dergelijke situatie hebben de MKB's geen andere keuze dan met innovaties te komen om te blijven bestaan in een steeds sterker wordende concurrentie en operationele voortreffelijkheden te bereiken. De eigenlijke innovaties die optreden in the MKB's zijn relatief bescheiden en de meeste MKB's leggen de nadruk op accumulerende innovaties in plaats van radicale. De MKB's besteedden veel aandacht aan

productinnovatie dat prompt leidde tot financiële voordelen en minder riskant was, terwijl er minder aandacht besteed was aan proces en organisatorische innovatie. Externe kennis vergaard door intensieve interactie met verschillende externe partijen heeft invloed op het stimuleren van innovatie binnen de MKB's.

Hoewel de firma's in dit onderzoek twee sectoren representeren die compleet anders zijn, ondanks de verschillen in sommige aspecten (export marktaandeel, opleidingsniveau van de werknemers) delen de firma's ook een aantal veelvoorkomende eigenschappen die gerelateerd zijn aan innovatie. De meeste van de bedrijf's hadden geen goedgeplande activiteiten die leidden tot innovatie. Vaak werden initiatieven die leiden tot innovaties impulsief uitgevoerd zonder enige voorafgaande formele planning, ter aanvulling op het feit dat maar een paar firma's een specifieke O&O afdeling hadden, welke verantwoordelijk is voor de innovaties. Door deze context is het scheiden van de initiatieven (potentieel absorptievermogen) van de innovaties (realiseren van absorptievermogen) geen voorzichtige keuze. Deze scheiding is niet gebaseerd op de grootte van de bedrijf's of de context van de opkomende economie maar op de slechte planning bij de bedrijf's. Als we rekening houden met dit gegeven zijn de resultaten van deze studie toepasbaar op iedere firma waarbij een goede planning voor innovatie ontbreekt. Aan de andere kant, zelfs in de context van MKB's in ontwikkelingslanden, waar de planningfase wel goed uitgevoerd wordt (zoals in de bouwsector) is het scheiden van potentieel en gerealiseerd absorptievermogen een belangrijke optie (cf. Waalkens, 2006).

De bevindingen van deze studie zouden gebruikt kunnen worden als de basis voor het opzetten van toepasselijke initiatieven en een toepasselijk beleid om MKB's te promoten, vooral in de context van opkomende economieën. Beleidsmakers zoals rijksbetrekkingen en industrie associaties kunnen een meer intensieve rol spelen in het leveren van faciliteiten voor de MKB's, inclusief het toegang verlenen tot informatie over nieuwe producten die de markt prefereert, informatie verstrekken over nieuwe potentiële markten, informatie over de beschikbaarheid van ruw materiaal om de duurzaamheid te waarborgen – vooral hout, vervaardigd van door de regering beheerde bossen, in de context van de meubelsector. Ter aanvulling, zou significante aandacht moeten worden besteed aan activiteiten omtrent het avanceren van de capaciteiten voor MKB's om toegang te krijgen tot informatie in een andere taal en via Internet, dat nog steeds niet genoeg toegepast wordt.

Appendix A. The Questionnaire

Part A. The Owner/Manager

Please answer the following questions by crossing the option(s) or filling your answer in the provided space.

1. Gender: 1. Female 2. Male

2. Year of birth: _____

3. Highest education level:
   1. Not completed elementary school 2. Elementary school
   3. Junior high school 4. Senior high school
   5. University

4. Have you been working before starting this venture?
   1. Never (*jump to no. 6*) 2. Yes

5. If 'yes', in what sector (*select all applicable*)?
   1. Public 2. Private 3. Self-employed

6. As you see from the table below, please fill the number of percentage for each source of share/loan when you started your firm. Please use (–) to indicate not available. Note: Total of source of share/loan is 100%.

No.	*Source of share/loan*	*%*
1	Personal savings	
2	Family investment	
3	Joint-sources with colleagues/friends	
4	Bank	
5	Other, please specify: _____	
	Total	100%

7.a. Is the firm your main business? 1. Yes 2. No

7.b. If yes, are you fully employed? 1. Yes 2. No

8. Who is involved in managing the firm? (*multiple answers possible*)
   1. Myself 2. Family 3. Colleagues/friends
   4. Other, please specify _____

Part B. The Firm

9. Month and year of establishment _____/_____ (mm/yy)

10. When did your company start to grow after its establishment?
    1. Not growing 2. After 6 months 3. After 1 year
    4. After 1.5 years 5. After two years

11. Location:
    1. Town/urban 2. Sub-urban 3. Rural/Village

12. Who started the firm? (*multiple answers possible*)
    1. Yourself 2. Your parents
    3. Other, please specify _____

13. Status of the firm
    1. Independent 2. Subsidiary 3. Cooperative structure

14. What are the major group of products/services your firm produced within the past two years, please mention *three* of them,
    1. _____
    2. _____
    3. _____

15. What is the monthly average net revenue of the firm in the past two years:
    1. Revenue ≤ Rp 50.000.000
    2. Rp 50.000.000 < revenue ≤ Rp 100.000.000
    3. Rp 100.000.000 < revenue ≤ Rp150.000.000
    4. Revenue ≥ Rp150.000.000

For software firm:

16. What is the percentage of the turnover of your products (resulting in a total of 100%):
    1. Domestic ____ %
       1. Education ____ %
       2. Health care ____ %
       3. Government ____ %
       4. Private ____ %
       5. Other, please specify ____ %

       (100%)
    2. Export ____ %

       (100%)

       Please specify the destination countries _____

For furniture firm:

16. What is the percentage of the turnover of your products (resulting in a total of 100%):
    1. Domestic ____ %
    2. Export ____ %
    Please specify the destination countries _____

17. Number of employees: 1. Full time ____ person(s) 2. Part time ____ person(s)

18. Maximum education of full employees:

1. Not completed elementary school	____ person(s)	*Must be the same*
2. Elementary school	____ person(s)	
3. Junior high school	____ person(s)	
4. Senior high school	____ person(s)	
5. University	____ person(s)	
Total	____ person(s)	

19. Does the firm have a special department for innovation (i.e., R&D department)?
    1. Yes (jump to *no. 20*) 2. No (jump to *no. 21*)

20. If 'yes', how many employees are involved in the department? ____ person(s)

21. If 'no', who is performing the innovation function in your firm? (*multiple answers are allowed*)
    1. Owner 2. Manager 3. One of the employees
    4. Other, please specify _____

22. Based on your experience within the past two years, how is the contribution of the following parties/employees of own firm on stimulating innovation initiatives taken by the firm? Note: n/a=not applicable; 1=less important, 5=very important

No.	*Party*	*less important*				*very important*
1	Employees of own firm	1	2	3	4	5
2	Buyers/customers	1	2	3	4	5
3	Suppliers	1	2	3	4	5
4	Consultants	1	2	3	4	5
5	Government offices	1	2	3	4	5
6	Competitors	1	2	3	4	5
7	Industry associations	1	2	3	4	5
8	Religious associations	1	2	3	4	5
9	Research institutions/universities	1	2	3	4	5

Part C. Absorptive Capacity

23. Based on your experience within the past two years, how often initiatives towards each type of innovation (really new for your own firm) are taken:

No.	*Type of innovation*	*seldom*				*very often*
1	Product/service innovation	1	2	3	4	5
2	Process innovation	1	2	3	4	5
3	Organizational innovation	1	2	3	4	5

24. Based on your experience within the past two years, how often initiatives towards each type of innovation (modification for your own firm) are taken:

No.	*Type of innovation*	*seldom*				*very often*
1	Product/service innovation	1	2	3	4	5
2	Process innovation	1	2	3	4	5
3	Organizational innovation	1	2	3	4	5

25. How often does the firm make each type of innovation for making really new for your own firm, within the past two years:

No.	*Type of innovation*	*seldom*				*very often*
1	Product/service innovation	1	2	3	4	5
2	Process innovation	1	2	3	4	5
3	Organizational innovation	1	2	3	4	5

26. Based on your experience within the past two years, how often does the firm make each type of innovation for making modification for your own firm:

No.	*Type of innovation*	*seldom*				*very often*
1	Product/service innovation	1	2	3	4	5
2	Process innovation	1	2	3	4	5
3	Organizational innovation	1	2	3	4	5

27. The following are several innovation activities conducted in your firm within the past two years. Please rate each of innovation activities. Note: 1= seldom and 5= very often.

No.	*Activity*	*seldom*				*very often*
1	Our firm accepts demand that go beyond existing products and services	1	2	3	4	5
2	We frequently refine the provision of existing products and services	1	2	3	4	5
3	We invent new products and services	1	2	3	4	5
4	We regularly implement small adaptations to existing products and services	1	2	3	4	5
5	We experiment with new products and services in our local market	1	2	3	4	5
6	We introduce improved, but existing products and services	1	2	3	4	5
7	We commercialize products and services that are completely new to our unit	1	2	3	4	5
8	We improve our provision's efficiency of products and services	1	2	3	4	5
9	We frequently utilize new opportunities in new markets	1	2	3	4	5
10	We increase economies of scales in existing markets	1	2	3	4	5
11	Our firm regularly uses new distribution channels	1	2	3	4	5
12	Our firm expands services for existing clients	1	2	3	4	5
13	Lowering costs of internal processes is an important objective	1	2	3	4	5

Part D. Stickiness of external knowledge

33. Based on your experience within the past two years, please indicate what specific knowledge content your firm gets from external parties. If an external party is not relevant, put a cross (x) in 0. Please indicate also the depth of knowledge on the domain. 1=the external party gives only a very little knowledge on the domain, 3=the external party gives some knowledge on the domain, 5=the external party gives a lot of knowledge on the domain.

No.	*Source*	*Knowledge domain/content*		
		Product	*Process*	*Organizational*
1	Buyers	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
2	Suppliers	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
3	Competitors	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
4	Consultants	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
5	Government offices	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
6	Industry association	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
7	Religious affiliations	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
8	Research institution/ university	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
9	Exhibitions	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
10	Magazines/ newspapers	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
11	Television	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
12	Radio	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
13	Internet	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5

34. Based on your experience within the past two years, how easily can you show or demonstrate in practice or in behavior knowledge from the following external parties/sources within your firm? Note: 1= very easy and 5= very difficult

No	*Source*	*very easy*				*very difficult*
1	Buyers/customers	1	2	3	4	5
2	Suppliers	1	2	3	4	5
3	Competitors	1	2	3	4	5
4	Consultants	1	2	3	4	5
5	Government offices	1	2	3	4	5
6	Industry associations	1	2	3	4	5
7	Religious affiliations	1	2	3	4	5
8	Research institutions/universities	1	2	3	4	5
9	Exhibitions	1	2	3	4	5
10	Magazines/newspapers	1	2	3	4	5
11	Television	1	2	3	4	5
12	Radio	1	2	3	4	5
13	Internet	1	2	3	4	5

35. Based on your experience within the past two years, how easily can you write down in terms of manuals, instruction guides and procedures, knowledge from the following external parties within your firm? Note: 1= very easy and 5= very difficult

No	*Source*	*very easy*				*very difficult*
1	Buyers/customers	1	2	3	4	5
2	Suppliers	1	2	3	4	5
3	Competitors	1	2	3	4	5
4	Consultants	1	2	3	4	5
5	Government offices	1	2	3	4	5
6	Industry associations	1	2	3	4	5
7	Religious affiliations	1	2	3	4	5
8	Research institutions/universities	1	2	3	4	5
9	Exhibitions	1	2	3	4	5
10	Magazines/newspapers	1	2	3	4	5
11	Television	1	2	3	4	5
12	Radio	1	2	3	4	5
13	Internet	1	2	3	4	5

36. Based on your experience within the past two years, how easily can you explain in terms of why and how, knowledge from the following external parties within your firm? Note: 1= very easy and 5= very difficult

No	*Source*	*very easy*				*very difficult*
1	Buyers/customers	1	2	3	4	5
2	Suppliers	1	2	3	4	5
3	Competitors	1	2	3	4	5
4	Consultants	1	2	3	4	5
5	Government offices	1	2	3	4	5
6	Industry associations	1	2	3	4	5
7	Religious affiliations	1	2	3	4	5
8	Research institutions/universities	1	2	3	4	5
9	Exhibitions	1	2	3	4	5
10	Magazines/newspapers	1	2	3	4	5
11	Television	1	2	3	4	5
12	Radio	1	2	3	4	5
13	Internet	1	2	3	4	5

37. How well documented was the knowledge that your firm obtained from the following external parties/sources, starting from picture/icons until formulations?

No.	*Source*	*icons/ pictures*	*diagrams*	*scheme*	*language /texts*	*formulas*
1	Buyers/customers	1	2	3	4	5
2	Suppliers	1	2	3	4	5
3	Competitors	1	2	3	4	5
4	Consultants	1	2	3	4	5
5	Government offices	1	2	3	4	5
6	Industry associations	1	2	3	4	5
7	Religious affiliations	1	2	3	4	5
8	Research institutions/universities	1	2	3	4	5
9	Exhibitions	1	2	3	4	5
10	Magazines/newspapers	1	2	3	4	5
11	Television	1	2	3	4	5
12	Radio	1	2	3	4	5
13	Internet	1	2	3	4	5

Part E. Interaction of behaviour

38. Based on your experience within the past two years, does your firm ever make interactions with *buyers/ customers*?
    1. No (*continue to no. 39*)
    2. Yes. Can you indicate in what way your firm makes these interactions?

No.	*Interaction medium*	*occasionally*	*monthly*	*weekly*	*several times a week*	*daily*
1	Formal direct meeting	1	2	3	4	5
2	Informal direct meeting	1	2	3	4	5
3	Telephone	1	2	3	4	5
4	Paper/facsimile	1	2	3	4	5
5	Email	1	2	3	4	5
6	Other, please specify_____	1	2	3	4	5

39. Based on your experience within the past two years, does your firm ever make interactions with *suppliers*?
    1. No (*continue to no. 40*)
    2. Yes. Can you indicate in what way your firm makes these interactions?

No.	*Interaction medium*	*occasionally*	*monthly*	*weekly*	*several times a week*	*daily*
1	Formal direct meeting	1	2	3	4	5
2	Informal direct meeting	1	2	3	4	5
3	Telephone	1	2	3	4	5
4	Paper/facsimile	1	2	3	4	5
5	Email	1	2	3	4	5
6	Other, please specify_____	1	2	3	4	5

40. Based on your experience within the past two years, does your firm ever make interactions with *competitors*?
    1. No (*continue to no. 41*)
    2. Yes. Can you indicate in what way your firm makes these interactions?

No.	*Interaction medium*	*occasionally*	*monthly*	*weekly*	*several times a week*	*daily*
1	Formal direct meeting	1	2	3	4	5
2	Informal direct meeting	1	2	3	4	5
3	Telephone	1	2	3	4	5
4	Paper/facsimile	1	2	3	4	5
5	Email	1	2	3	4	5
6	Other, please specify_____	1	2	3	4	5

41. Based on your experience within the past two years, does your firm ever make interactions with *consultants*?
    1. No (*continue to no. 42*)
    2. Yes. Can you indicate in what way your firm makes these interactions?

No.	*Interaction medium*	*occasionally*	*monthly*	*weekly*	*several times a week*	*daily*
1	Formal direct meeting	1	2	3	4	5
2	Informal direct meeting	1	2	3	4	5
3	Telephone	1	2	3	4	5
4	Paper/facsimile	1	2	3	4	5
5	Email	1	2	3	4	5
6	Other, please specify_____	1	2	3	4	5

42. Based on your experience within the past two years, does your firm ever make interactions with *government offices*?
    1. No (*continue to no. 43*)
    2. Yes. Can you indicate in what way your firm makes these interactions?

No.	*Interaction medium*	*occasionally*	*monthly*	*weekly*	*several times a week*	*daily*
1	Formal direct meeting	1	2	3	4	5
2	Informal direct meeting	1	2	3	4	5
3	Telephone	1	2	3	4	5
4	Paper/facsimile	1	2	3	4	5
5	Email	1	2	3	4	5
6	Other, please specify_____	1	2	3	4	5

43. Based on your experience within the past two years, does your firm ever make interactions with *industry associations*?
    1. No (*continue to no. 44*)
    2. Yes. Can you indicate in what way your firm makes these interactions?

No.	*Interaction medium*	*occasionally*	*monthly*	*weekly*	*several times a week*	*daily*
1	Formal direct meeting	1	2	3	4	5
2	Informal direct meeting	1	2	3	4	5
3	Telephone	1	2	3	4	5
4	Paper/facsimile	1	2	3	4	5
5	Email	1	2	3	4	5
6	Other, please specify_____	1	2	3	4	5

44. Based on your experience within the past two years, does your firm ever make interactions with *religious affiliations*?
    1. No (*continue to no. 45*)
    2. Yes. Can you indicate in what way your firm makes these interactions?

No.	*Interaction medium*	*occasionally*	*monthly*	*weekly*	*several times a week*	*daily*
1	Formal direct meeting	1	2	3	4	5
2	Informal direct meeting	1	2	3	4	5
3	Telephone	1	2	3	4	5
4	Paper/facsimile	1	2	3	4	5
5	Email	1	2	3	4	5
6	Other, please specify_____	1	2	3	4	5

45. Based on your experience within the past two years, does your firm ever make interactions with *research institutions/universities*?
    1. No (*continue to no. 46*)
    2. Yes. Can you indicate in what way your firm makes these interactions?

No.	*Interaction medium*	*occasionally*	*monthly*	*weekly*	*several times a week*	*daily*
1	Formal direct meeting	1	2	3	4	5
2	Informal direct meeting	1	2	3	4	5
3	Telephone	1	2	3	4	5
4	Paper/facsimile	1	2	3	4	5
5	Email	1	2	3	4	5
6	Other, please specify_____	1	2	3	4	5

46. Based on your experience within the past two years, at average, how many times your firm have attended *exhibitions*?
    1. Never 2. Once a year 3. Twice a year
    4. Three times a year 5. More than four times

47. Based on your experience within the past two years, at average, how many hours a day your firm accessed to *magazines/newspapers*?
    1. Never 2. Less than 30 min 3. About 1 hour
    4. Two hours 5. More than three hours

48. Based on your experience within the past two years, at average, how many hours a day your firm accessed to *television*?
    1. Never 2. Less than 30 min 3. About 1 hour
    4. Two hours 5. More than three hours

49. Based on your experience within the past two years, at average, how many hours a day your firm accessed to *radio*?
    1. Never 2. Less than 30 min 3. About 1 hour
    4. Two hours 5. More than three hours

50. Based on your experience within the past two years, at average, how many hours a day your firm accessed to *Internet*?
    1. Never 2. Less than 30 min 3. About 1 hour
    4. Two hours 5. More than three hours

Part F. Obstacles

51. Based on your experiences so far, do you find any obstacles in gathering the necessary knowledge from the external parties?

No.	Obstacle	*very little*				*very high*
1	Financial	1	2	3	4	5
2	High level of complexity of new knowledge	1	2	3	4	5
3	Large physical distance to knowledge source	1	2	3	4	5
4	Other language	1	2	3	4	5
5	Other, please specify _____	1	2	3	4	5

Appendix B. Detailed Tables for Chapter 7

This appendix consists of the detailed tables referred in Chapter 7 of this thesis.

Table B.1. Knowledge domain

Source	*Furniture firms*			*Software firms*		
	Product	*Process*	*Organizational*	*Product*	*Process*	*Organizational*
Buyers	3.37	1.16	1.30	2.69	1.19	1.96
Suppliers	0.96	1.40	0.54	1.02	1.27	0.93
Competitors	1.59	1.08	0.97	2.19	1.69	1.68
Consultants	0.34	0.27	0.43	0.78	0.58	0.71
Government offices	0.32	0.29	0.56	0.69	0.51	0.74
Industry associations	0.93	0.77	1.01	0.47	0.46	0.61
Religious affiliations	0.23	0.19	0.28	0.33	0.24	0.35
Research institutions/ universities	0.26	0.19	0.19	1.27	1.10	0.96
Exhibitions	2.31	0.99	1.33	1.65	1.23	1.11
Magazines/ newspapers	2.25	1.17	1.21	1.79	1.59	1.45
Television	1.07	0.59	0.49	0.68	0.69	0.76
Radio	0.09	0.11	0.12	0.32	0.30	0.46
Internet	2.11	1.10	1.31	3.59	3.37	2.80
Direct individual	1.57	0.98	0.81	1.67	1.18	1.32
Direct institutional	0.44	0.36	0.51	0.69	0.58	0.66
Indirect	1.57	0.79	0.89	1.61	1.44	1.32
All	1.22	0.72	0.75	1.34	1.09	1.12

Note: Measured using 5-point Likert scale (0=not at all, 1=a few knowledge domains, 5=a lot of knowledge domains).

Table B.2. Interconnectedness of knowledge

Source	*Interconnectedness*	
	Furniture firms	*Software firms*
Buyers	1.70	1.83
Suppliers	0.78	0.98
Competitors	1.13	1.79
Consultants	0.28	0.64
Government offices	0.32	0.61
Industry associations	0.84	0.48
Religious affiliations	0.20	0.28
Research institutions/universities	0.19	1.06
Exhibitions	1.43	1.25
Magazines/newspapers	1.42	1.53
Television	0.61	0.66
Radio	0.09	0.33
Internet	1.42	3.22
Direct individual	0.97	1.31
Direct institutional	0.39	0.61
Indirect	0.99	1.40
All	0.80	1.13

Note: Score of interconnectedness range from 0=not at all, 1= very low to 5=very high

Table B.3. Sensory knowledge

Source of knowledge	*Both sectors*		*Furniture firms*		*Software firms*		t^b	
	Mean[a]	*SD*	*Mean*	*SD*	*Mean*	*SD*		
Buyers	3.66	0.97	3.79	0.93	3.54	1.00	1.78	*
Suppliers	3.33	1.01	3.62	1.01	3.07	0.95	2.98	***
Competitors	3.18	1.02	3.22	1.05	3.15	1.01	0.34	
Consultants	3.24	1.01	3.50	0.97	3.12	1.02	1.24	
Government offices	2.83	1.13	2.93	0.92	2.75	1.27	0.61	
Industry associations	2.99	1.11	3.22	1.08	2.66	1.08	2.15	**
Religious affiliations	3.04	1.16	3.38	1.04	2.71	1.20	1.54	
Research institutions/universities	2.93	1.05	3.13	0.74	2.87	1.12	0.85	
Exhibitions	3.30	1.03	3.41	0.93	3.19	1.12	1.22	
Magazines/newspapers	3.30	1.04	3.35	1.00	3.25	1.09	0.58	
Television	2.85	1.06	2.96	1.11	2.74	1.02	0.97	
Radio	2.27	1.12	2.13	1.46	2.31	1.04	-0.41	
Internet	3.90	0.95	3.69	0.88	4.02	0.97	-2.03	**
Direct individual	3.48	0.84	3.62	0.86	3.35	0.80	2.27	**
Direct institutional	3.02	1.01	3.18	0.97	2.88	1.04	1.64	
Indirect	3.37	0.83	3.34	0.84	3.39	0.83	-0.33	
All	3.35	0.73	3.44	0.76	3.27	0.70	1.67	*

Notes:

[a] Measured using 5-point Likert scale (1=little sensory and 5=much sensory)

[b] For mean comparison between the two sectors

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

Table B.4. Coded knowledge

Source of knowledge	*Both sectors*		*Furniture firms*		*Software firms*		t^b	
	Mean[a]	*SD*	*Mean*	*SD*	*Mean*	*SD*		
Buyers	3.66	1.08	3.90	0.98	3.42	1.11	-3.34	***
Suppliers	3.38	1.09	3.88	0.87	2.86	1.05	0.86	
Competitors	3.06	1.12	3.28	1.04	2.89	1.15	-1.57	
Consultants	3.32	1.11	3.53	1.07	3.22	1.13	2.97	***
Government offices	2.75	1.18	3.25	1.04	2.36	1.15	-1.79	*
Industry associations	3.07	1.19	3.50	0.95	2.43	1.22	1.55	
Religious affiliations	3.37	1.04	3.79	0.80	2.92	1.12	-0.81	
Research institutions/universities	2.96	1.23	3.33	0.98	2.85	1.28	-1.23	
Exhibitions	3.30	1.15	2.69	0.98	2.90	1.18	-0.61	
Magazines/newspapers	3.39	1.12	3.64	1.09	3.15	1.10	-2.43	**
Television	2.96	1.28	3.38	1.24	2.51	1.18	-3.46	***
Radio	2.43	1.26	2.63	1.60	2.38	1.18	-0.61	
Internet	4.05	0.85	3.89	0.90	4.15	0.81	-4.51	***
Direct individual	3.42	0.98	3.70	0.92	3.15	0.96	4.00	***
Direct institutional	3.01	1.12	3.45	0.96	2.65	1.13	4.14	***
Indirect	3.50	0.89	3.65	0.90	3.35	0.85	2.35	***
All	3.37	0.85	3.61	0.85	3.15	0.79	3.88	***

Notes:

[a] Measured using a 5-point Likert scale (1= less coded and 5=more coded)

[b] For a mean comparison between the two sectors

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

Table B.5. Theoretical knowledge

Source of knowledge	*Both sectors*		*Furniture firms*		*Software firms*		*t*[b]	
	Mean[a]	*SD*	*Mean*	*SD*	*Mean*	*SD*		
Buyers	3.77	1.00	3.91	0.88	3.64	1.09	1.88	*
Suppliers	3.39	1.12	3.79	0.97	2.98	1.12	4.43	***
Competitors	3.26	1.03	3.43	0.99	3.13	1.04	1.67	*
Consultants	3.26	1.04	3.71	0.90	3.00	1.04	2.62	***
Government offices	3.07	1.02	3.25	1.16	2.92	0.87	1.35	
Industry associations	2.99	1.09	3.42	0.97	2.37	0.98	4.67	***
Religious affiliations	2.83	0.95	3.20	0.94	2.47	0.83	2.26	**
Research institutions/universities	2.95	1.08	3.18	1.07	2.88	1.08	1.00	
Exhibitions	3.36	1.19	3.69	1.08	3.15	1.04	3.54	***
Magazines/newspapers	3.41	1.10	3.66	1.10	2.81	1.20	2.87	***
Television	3.11	1.33	3.41	1.40	2.60	1.20	2.25	**
Radio	2.51	1.19	2.22	1.64	2.60	1.04	-0.83	
Internet	3.99	0.87	3.90	0.87	4.05	0.86	-1.08	
Direct individual	3.55	0.93	3.78	0.84	3.33	0.97	3.39	***
Direct institutional	3.08	1.01	3.35	0.99	2.85	0.97	2.87	***
Indirect	3.51	0.92	3.63	0.97	3.40	0.88	1.73	*
All	3.46	0.86	3.63	0.86	3.29	0.83	2.86	***

Notes:

[a] Measured sing a 5-point Likert scale (1= least theoretical and 5=most theoretical);

[b] For a mean comparison between the two sectors;

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

Table B.6. Frequency of interaction

Source	*Furniture firms (%)*			*Software firms (%)*			χ^2	
	Never	*Seldom*	*Often*	*Never*	*Seldom*	*Often*		
Direct individual								
Buyers	2.0	63.0	35.0	2.0	40.0	58.0	10.82	***
Suppliers	24.0	57.0	19.0	45.0	39.0	16.0	10.02	***
Competitors	44.0	49.0	7.0	34.0	61.0	5.0	2.92	
Consultants	79.0	18.0	3.0	62.0	34.0	4.0	7.12	**
Direct institutional								
Government offices	68.0	32.0	0.0	59.0	35.0	6.0	6.77	**
Industry associations	52.0	42.0	6.0	63.0	35.0	2.0	3.69	
Religious affiliations	83.0	15.0	2.0	82.0	13.0	5.0	1.44	
Research institutions/ universities	84.0	15.0	1.0	49.0	44.0	7.0	27.96	***
Indirect								
Exhibitions	26.0	60.0	14.0	29.0	53.0	18.0	1.10	
Magazines/ newspapers	22.0	78.0	0.0	12.0	86.0	2.0	5.33	*
Television	36.0	61.0	3.0	44.0	50.0	6.0	2.89	
Radio	86.0	13.0	1.0	74.0	24.0	2.0	4.50	
Internet	38.0	42.0	20.0	0.0	30.0	70.0	67.78	***

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

Table B.7. Comparing interaction channels

Source	*n*	*Traditional*		χ^2	*Non-traditional*		χ^2
		Furniture	*Software*		*Furniture*	*Software*	
Buyers	Never	2	1	14.86 ***	6	3	5.46 *
	Seldom	46	21		55	42	
	Often	52	78		39	55	
Suppliers	Never	14	44	30.20 ***	28	46	7.75 **
	Seldom	35	37		57	39	
	Often	51	19		15	15	
Competitors	Never	33	32	0.99	55	36	7.39 **
	Seldom	43	49		41	57	
	Often	24	19		4	7	
Consultants	Never	79	62	7.12 **	76	64	4.10
	Seldom	18	34		19	25	
	Often	3	4		5	11	
Government offices	Never	55	58	4.39	75	61	7.08 **
	Seldom	40	30		24	32	
	Often	5	12		1	7	
Industry associations	Never	52	63	3.69	48	63	6.70 **
	Seldom	42	35		40	33	
	Often	6	2		12	4	
Religious affiliations	Never	83	82	1.44	79	82	0.99
	Seldom	15	13		10	11	
	Often	2	5		11	7	
Research institutions/ universities	Never	76	47	21.05 ***	86	51	28.91 ***
	Seldom	22	38		13	41	
	Often	2	15		1	8	

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

Table B.8. Promoters of innovation

Promoter of innovation	*Both sectors*	*Furniture firms*	*Software firms*
Internal (i.e. employee of the firm)	3.26	2.89	3.57
External (individual)	3.18	3.20	3.15
1. Buyers	3.69	3.81	3.57
2. Suppliers	2.53	2.61	2.45
3. Competitors	3.21	3.07	3.32
4. Consultants	2.53	2.60	2.49
External (institutional)	2.39	2.32	2.45
1. Government offices	2.13	1.94	2.29
2. Industry associations	2.51	2.58	2.42
3. Religious affiliations	2.51	2.71	2.29
4. Research institutions/universities	2.42	2.10	2.60

Note: Measured using 5-point Likert scale (from 1=less important to 5=very important)

Table B.9. Results of the regression analysis for furniture firms

Variable	*Model 1*		*Model 2*	
	β	*t*	*β*	*t*
Knowledge interconnectedness	0.45	5.01 ***	0.29	2.42 **
Sensory knowledge	-1.98	-1.68 *	-1.48	-1.24
Coded knowledge	0.39	3.18 ***	0.39	3.27 ***
Theoretical knowledge	0.02	0.13	-0.01	-0.04
Interaction			0.23	1.94 *
F (4, 83); (5, 82)	12.96 ***		11.47 ***	
R^2	0.38		0.41	
Adjusted R^2	0.36		0.38	

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

Table B.10. Results of the regression analysis for software firms

Variable	*Model 1*		*Model 2*	
	β	*t*	*β*	*t*
Knowledge interconnectedness	0.35	3.50 ***	0.26	2.19 **
Sensory knowledge	0.150	1.15	0.15	1.13
Coded knowledge	-0.04	-0.32	-0.07	-0.53
Theoretical knowledge	0.12	0.76	0.16	1.01
Interaction			0.16	1.27
F (4, 91); (5, 90)	3.93 ***		3.49 ***	
R^2	0.15		0.16	
Adjusted R^2	0.11		0.12	

Note: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

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